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New Works of the Green Island Cement Company, Ltd., Hong-Kong

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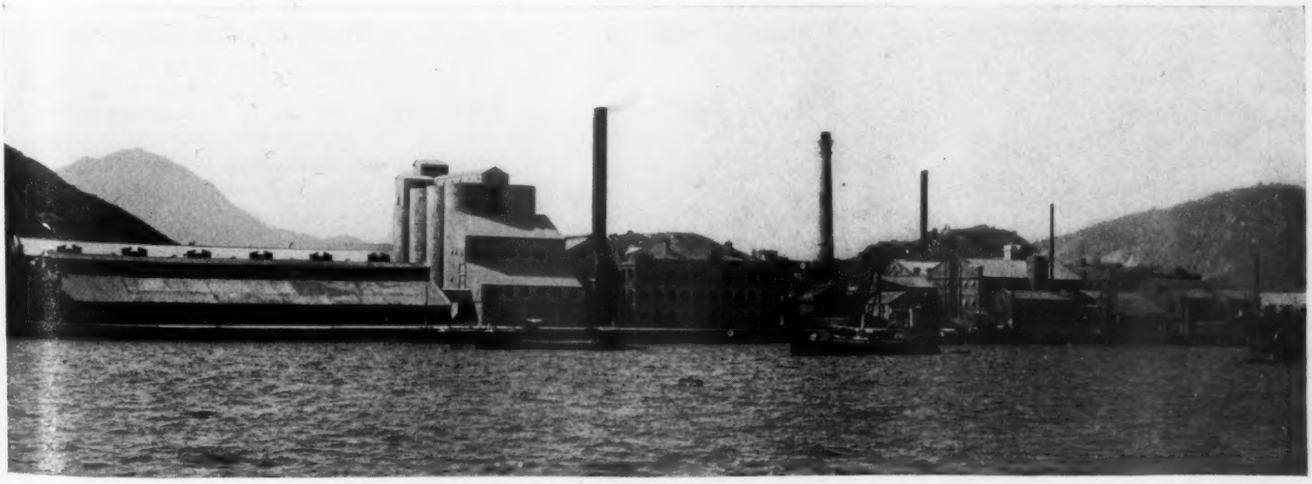
THE Green Island Cement Co., Ltd., was founded towards the end of the last century and established its first cement making works at Macao, in Portuguese territory, in 1889. In 1899 the company, which was always British, extended its activities to Hong-Kong and established in that year a battery of Aalborg kilns at Hok Un in Kowloon, on the mainland of China in British territory. In 1904 and 1905 the Hong-Kong plant was remodeled by the establishment of two early-type rotary kilns, working on the dry process, and these were duplicated shortly afterwards. These kilns were 87 ft. long and the four still produce about 1000 tons of clinker per week. In 1923 two of the Aalborg kilns were adapted to the mechanical-grate system, as an experiment to find if it was worth while modernizing the other Aalborg kilns in the same way. Soon after this it was decided to establish an entirely new rotary plant, but when all the necessary investigations had been made and the preliminary plans prepared, a boycott and strike in Hong-Kong in 1925 prevented further immediate work. In 1926 the Aalborg kiln plant was demolished and the site prepared for a new rotary plant.

In 1929 the company decided to build its new works, and from that time the new plant began to take shape. It was decided to manufacture at least 100,000 tons of cement per annum with two new kilns and the necessary grinding, crushing and mixing machinery. In practice the output is found to exceed the guaranteed figure, and 100,000 tons of ordinary portland cement can be manufactured in addition to 10,000 to 15,000 tons of rapid-hardening cement The new plant was completed in October, 1931. In the new works a change was made from the dry process to the wet process of manufacture. The reasons for this were that it was thought a better proportioning of the raw materials could be maintained on the wet system, and therefore a better quality of clinker should be expected; the power taken to grind the clinker on the wet process is usually somewhat less, and there is no necessity on the wet process to use dried clay, which comes from Macao, for the old dry-process plant. Wet clay is dug from the sea bottom and transferred to the works in the company's own lighters. The cost of clay was therefore considerably reduced. Finally, the dry process makes more dust. In this respect the company had to be careful, as the works are situated in an area where dust is banned by the Hong-Kong government, so much so that at one time the authorities threatened to force the company to move to another locality.

Later developments in the dry process somewhat modify these arguments, but when the works were being thought out they influenced the adoption of the wet process.

The reconstruction of the works was particularly interesting in that it was necessary to fit the new plant into the site once occu-



General view of plant of Green Island Cement Co., Hong-Kong, China, showing, from left to right, the old cement godown, new silos, offices and old dry process plant

TYPICAL ANALYSIS OF LIMESTONE

	Haiphong limestone	Canton limestone	Japanese limestone
Carbonate of lime	95.02	87.95	98.74
Carbonate of magnesia	4.57	2.27	1.15
Silica	trace	8.24	0.33
Alumina and oxide of iron	0.25	{ 0.76 } { 0.54 }	0.48
Sulphuric anhydride	nil	trace	nil
Alkalis and loss	0.30	0.07	0.09
Water and organic matter	0.06	0.17	0.10

AVERAGE ANALYSIS OF COALS

	Volatile matter	Ash	Fixed carbon	Calorific value
Japanese	40%	12%	46%	13,000 B.t.u.
Hongay	10%	9%	8%	13,000 B.t.u.

pied by the old Aalborg kilns and auxiliary machinery. Furthermore, there had to be no interference or interruption in the operation of the existing dry-process plant. These considerations necessitated the lay-out illustrated below, which shows the new plant and the old dry-process works. During construction the operation of the old works was not interfered with in any way.

The raw materials for the manufacture of cement in Hong-Kong are hard limestone and clay. The limestone comes from either the Canton district, Haiphong in French Indo-China or Japan, and as it is imported its cost is comparatively high. A large stock of limestone is always kept at the works, sometimes amounting to 250,000 tons. Typical analyses of the limestones used are shown on the following page.

There is an abundance of clay in all parts of the colony and this is reclaimed by dredging. A typical analysis of the main source of clay supply is: Loss on ignition, 10.55%; uncorrected silica, 62.18%; alumina, 14.70%; ferric oxide, 7.45%; lime, 3.07%; magnesia, 1.12%. The clay as loaded to the wash-mills contains about 37% of water.

The coal used comes from Japan and Hongay. The Japanese coal is more expensive and of a high volatile nature; Hongay coal is of an anthracitic nature and is the cheaper. The Hongay coal is mixed with the Japanese coal in the proportion of two to one. The average analysis of these coals is given in the table following.

Raw Material Handling

The limestone is delivered either by junk or large steamer; in the latter case it is unloaded from the steamer by junks which come alongside the pier, buckets from the ropeway being lowered into the hold and filled by hand. The limestone arrives in pieces varying from about 2½ ft. down to 6 in. The filled bucket is lifted on to the ropeway by crane and tipped from a height of about 50 ft. and stored in piles. To transport the limestone to the factory a 1¼ yd. crane operated by steam and mounted on a caterpillar track is used. The stone is loaded into 5-ton side-tipping steel wagons, which are then taken to the crusher hoppers by a small steam locomotive.

Clay is dredged a few hundred feet from the wharf, a floating crane and grab of about 4000 lb. capacity being used. This crane loads into lighters, each holding approximately 100 tons of wet clay. These, when full, are towed to the works and a locomotive crane transfers the clay either to the clay storage or direct to the wash-mills. The capacity of the locomotive crane is about 3850 lb. of wet clay when heaped and 2650 lb. when level full.

Coal is delivered in steamers, and is transhipped into junks or lighters and brought alongside the ropeway where buckets are lowered into the hold. The buckets are filled by hand and a crane on the jetty lifts them onto the ropeway. The coal is tipped into the end of the coal storage, from which point it is picked up by a traveling crane. The capacity in this case is 65 cu. ft. when flush and 81 cu. ft. when heaped.

The coal storage is divided into two parts by a roadway. The larger area is for the storage of Japanese coal which because of its high volatile nature can only be stored to a depth of about 8 ft. to avoid spontaneous combustion. The other portion is used for anthracitic Hongay coal, stored to a depth of 15 ft.

Each half of the storage has a capacity of about 2000 tons of coal, or approximately one ship load. In the corner of the coal storage at the opposite end from the ropeway two hoppers are arranged to receive the coal, one for Japanese and the other for Hongay coal. Under each hopper is a feeding device and a tipping-type weighing machine. The hopper of this machine is in the form of a barrel divided lengthways into four equal quarters and pivoted on the axis. The length of the barrel of the machine is 3 ft., while its diameter is 4 ft. As each quarter is filled with coal, the machine tips and the next quarter comes into position. No automatic weighing machine can be considered absolutely accurate for this purpose or for weighing clinker, for which a similar machine has been provided; the machine merely acts as an indicator. The storages are trimmed and measured for cubic contents each month to determine the quantity of coal used. The weighing machines tip the coal into two reinforced concrete bunkers, each having an untrimmed capacity of 20 tons. Under each hopper is a 48 in. diam. feed table furnished with a plough which transfers the coal to a belt conveyor. By means of the feed tables the proportion of one kind of coal to the other can be adjusted and the two coals are fed together on to a 20-in. inclined belt conveyor, 155 ft. long, and similar to that provided for crushed limestone described later. The drive is by a 15-hp. motor directly through reduction gearing. This conveyor transfers the coal into either of two reinforced concrete storage hoppers of 30 tons capacity each, above the coal mills.

View from tunnel showing crushing house at left and clinker storage at right

Sand is obtained in many places locally and is brought to the works by junk. It is unloaded by coolies, who transfer it in baskets to the sand storage. It is only required when the clay does not contain sand. Usually the clay obtained in front of the works contains a sufficient supply without addition.

A proportion of iron ore, containing about 95% of ferric oxide, is added by the arrangement provided for sand. This is obtained from a mine in the New Territories and is brought to the works by junk in small pieces.

Gypsum is imported from Algeria or elsewhere and is usually unloaded by the ropeway and stored in a convenient section of ground, whence it is transported by hand trucks to the gypsum storage in cement mill.

As mentioned, the clay is transferred by

the locomotive crane from either the reserve clay dump to the wash-mills or directly from the clay barges to the wash-mills. There are two wash-mills, both 14 ft. in diam., each capable of dealing with sufficient clay slurry for two kilns on a 60-hour per week basis. The speed of the wash-mill is 25 r.p.m. and it is belt driven by a 40 hp. motor.

The wash-mills are lined with locally quarried granite blocks of specially hard stone. Balanced steel gates, sliding vertically in a frame, are provided in a suitable position in each wash-mill wall for cleaning-out purposes. The clay used is entirely free from flints, but occasionally fairly large pieces of stone need to be removed. Also there is a quantity of sand which is cleaned out from time to time. This sand caused some trouble when starting up, owing to blockage in the return pipe from the clay slurry tank and this system had to be abandoned, as will be seen later. The wash-mills discharge into a common outlet, from which the pump suction pipe draws the clay slurry.

In the pump house there are three pumps, interchangeable with the slurry pumps. These are 8½ in. diam. by 16 in. stroke, direct driven plunger pumps, operated by a 15-hp. motor through worm reduction gearing. The crankshaft is driven by a worm drive. It was originally suggested that a raw-hide pinion should be used, but owing to the hot and humid climatic conditions during the Hong-Kong summer months raw-hide pinions are found to be unsuitable. The pump plungers are brass instead of cast iron; this was arranged as the pumps may be used for pumping sea water, and in addition the clay contains a considerable quantity of sea water. One pump is of sufficient capacity to deal with clay slurry from one wash-mill. A second pump is installed as a stand-by and the third pump in the clay pump house deals with sea water. Cast-iron flanged piping of 6-in. diam. carries the slurry to the small clay feed tank situated on top of the main clay slurry storage tank.

Raw Material Crushing

The limestone arrives in 5-ton side-tipping wagons hauled by a small steam locomotive. Pneumatic hoists are arranged in a convenient place for tipping purposes. Five tons of stone are tipped in this way into the receiving hoppers, of which there are three, 13 ft. by 10 ft., at the top. Underneath each hopper are finger feeders with seven bars, four stationary and three moving. These bars are arranged close together, and all the stone is passed forward to the crusher, where it is reduced to about 3 in. and under.

The three crushers are of the swinging-jaw type with main frames of cast steel and swinging jaws of toughened cast steel. The jaw faces are of manganese steel, ground on the back and designed to be removable and reversible. The drive is by belt and pulley and the finger feeder is operated by belt drive from the crusher. Two of the crushers are 30-in. by 18-in. and one is 24-in. by 13-in.

The crushed stone falls to a 20-in. inclined-belt conveyor 104 ft. long, inclined at an angle of 18 deg. The drive of the conveyor is by belt from the motor which operates the crushing rolls. There are three conveyors taking stone from each of the three crushers and feeding it to three roller mills. Each roller mill consists of two sets of smooth rolls, both 36 in. diam. by 36 in. face, and reduces the limestone to ¾ in. and under.

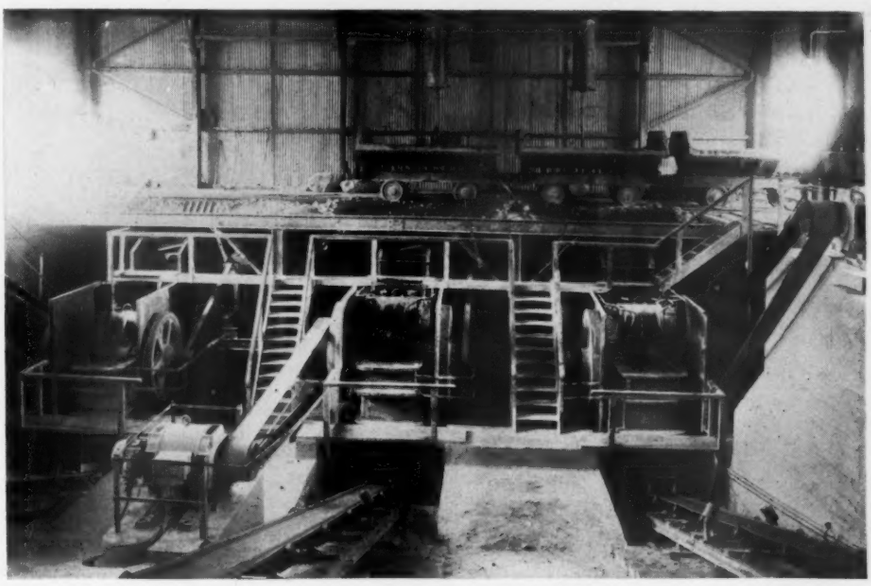
The crushed stone falls to a horizontal belt conveyor 30 in. wide and 48 ft. long which discharges into one of two 58-ft. elevators. The elevators are duplicated in case of breakdown and each has 24-in. buckets and a capacity of 60 tons per hour. The buckets are of pressed steel with a mild-steel reinforced lip on the front edge and are joined by two strands of cable chain, to which they are attached by special links. The drive of each elevator is by cast-steel machine-cut spur gear, with cut pinions on a countershaft which passes through the elevator head casing. This countershaft is driven by belting from a 20-hp. motor, which also operates the conveyor feeding the elevators. The motor is directly coupled to a totally-enclosed gear reducer mounted on the same bedplate as the motor. Flexible couplings are provided on both sides of the gear box.

The stone elevated in this way falls to a flat belt conveyor 40 in. wide on 110 ft. centers which discharges the crushed limestone into one of the three reinforced concrete hoppers which act as feeders and storage capacity for the three compound ball and tube mills. A point to note in this connection is that the end hopper usually contains more fine material than the other two on account of the dust and small stone which escape under the plough feeding either of the nearer bunkers. This affects the setting of the mill-feed table and increases the output of the corresponding mill. The stone is removed by hand-operated ploughs.

In order to produce the best results it is found advisable when using Canton limestone to add up to 5% of sand when the clay does not contain a sufficient quantity. When using the clay from the works' wharf the addition of sand is unnecessary and the sand arrangements can be used for iron ore. The clay in question is rather deficient in ferric oxide and the addition of a small percentage of iron ore acts as a flux and materially assists in the burning process. Also an adjustment of the silica-ferric oxide-alumina ratio enables the easier manufacture of rapid-hardening cement. Arrangements are provided to introduce this sand or iron ore to the three sand hoppers incorporated in the reinforced concrete structure of the limestone bunkers. These arrangements consist of a chute and an 8-in. vertical elevator of a similar type to that already described. This elevator delivers the sand or ore to a flat belt, which in turn feeds the three sand hoppers.

The motors driving the crushers, rolls, elevators and conveyors on the top of the bunkers are all electrically interlocked. The last mentioned is started first, then the elevator motor, rolls and finally the crushers. In the event of stoppage of the elevator motor, the rolls and crushers are automatically cut off. In a similar way the sand-elevator motor and sand-conveyor motor are also interlocked.

The jaw crushers are in a pit 19 ft. deep. The level of the water in the surrounding ground is about 4 ft. below the surface, and it was therefore necessary to introduce special waterproofing arrangements. A brick wall was built up and on the face of this wall a bitumastic waterproofing compound was plastered. To prevent the material being scraped off the wall when the concrete was being filled in, the compound was plastered over with cement grout. Afterwards the necessary forming was erected and the



Primary jaw crushers and belt conveyors to grinding plant

concrete walls of the crusher pit installed. It was found, however, that this method of waterproofing was inadequate, and inner surface of the concrete walls of the pit was treated with a different waterproofing compound. The last method proved satisfactory, with the exception of the place where the joists supporting the crushers were inserted in the concrete where slight leakage occurs.

Raw Grinding

The limestone from the crushing plant is deposited by the conveyor into one of the three reinforced concrete bunkers. Incorporated with the limestone bunkers are the sand or iron-ore bunkers. Under each limestone bunker is a 54-in. diam. feed table for feeding the crushed limestone to each of the raw mills, and under each sand or ore bunker there is a 36-in. diam. feed table. A pipe from the clay-feed tank feeds clay slurry to the mills, and on each outlet provision has been made for fitting a series of nozzles to the clay-feed pipe; these nozzles are from 5/8-in. diam. downwards in 16ths, and there are four or five nozzles for each pipe. By this means the clay valve can be left fully open and the feed of clay adjusted by nozzles; it is an easier matter to keep the feed of clay slurry regulated in this way than to depend upon the opening of a valve, especially with native labor and at night. A 3-in. pipe with controlling valve leads water to the mill inlet. The feed tables and water valves are fitted with indicators to enable an easy and constant regulation of the mix.

There are three raw mills each 40 ft. long by 6 ft. 6 in. in diam. The mills are divided into three compartments, the first chamber being lined with cast-steel plates and provided normally with a charge of three tons of 5-in. 0.8 carbon steel balls and three tons of 4-in. steel balls. The first chamber is 7 ft. 1¼ in. in length and the weight of steel balls is therefore 0.85 tons per foot run. The second chamber is lined with cast-steel plates and contains 3½ tons of 3-in. steel balls and 3½ tons of 2-in. steel balls. The second chamber is 9 ft. 1½ in. long, and therefore contains 0.77 tons of grinding media per foot run. The third chamber is lined with silex blocks and contains 8½ tons of 1-in. cast-iron cylpebs and 8½ tons of ¾-in. cast-iron cylpebs. The length of the third chamber is 22 ft. 6 in., and therefore the weight of grinding media per foot run is 0.75 tons. The intermediate and end diaphragm plates are of cast steel. That at the outlet is formed of renewable plates having tapered slots near the periphery through which the material is discharged by lifters through the outlet trunnion. The mill is supported in self-aligning cast-steel, water-cooled, greased trunnion bearings supported on cast-iron bedplates. The stepped lining plates vary in thickness from ⅞ in. to 3½ in., and are provided with countersunk cored holes for 1¼-in. bolts. The intermediate cast-steel lining plates are 1¼ in. thick. The gearing is totally enclosed. The speed of the mill countershaft is 132 r.p.m. The mill is operated through reduction gearing by a 475-hp. synchronous induction motor operating on 2200 volts. The enclosed reduction gear is of the single-reduction type with a nominal rating of 500 hp. The speed of the mill is 25 r.p.m. The guaranteed output of the mill is 13 tons of dry raw meal per hour when grinding slurry to 5% residue on the 180 mesh sieve.

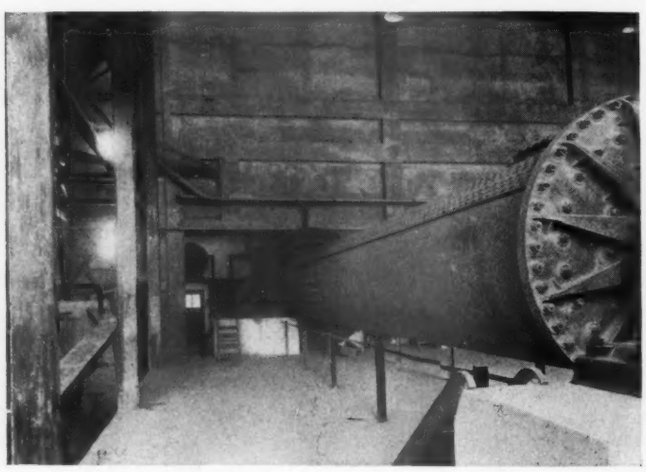
The mills are driven at the feed end, and the motor house is formed below the underside of the concrete limestone bunkers and is completely shut off from the mill house by a brick wall with three doors.

The slurry pumps are in the mill house and are of the same type as those described for clay slurry, except that they are furnished with cast-iron plungers. They are three in number and are interchangeable, one being used for pumping slurry from the mills to the correcting tanks, another for pumping from the tanks to the kiln feed tank and a third acting as a stand-by. In the slurry pump house a fourth 8-in. 3-throw pump, similar to those used for clay and slurry pumping, is installed to pump clay slurry from the large clay storage tank to the small clay feed tank on the top of it when the wash-mills are not operating. An endeavor was made to do without the fourth 8-in. pump by returning clay slurry by gravity through the pipe from the bottom of the main clay tank to the sump in the wash-mill. It was not possible to arrange an open launder. In this way clay slurry from both the wash-mill and the main clay tank was pumped by one of the clay pumps in the wash-mill. However, the sand and grit contained in the washed clay slurry soon silted up the return pipe and the fourth pump had to be installed. The pump used for pumping slurry to the kilns, instead of drawing directly from a tank, sucks the slurry from a sump filled from whichever tank or tanks are being used for this purpose. The sump is situated in the slurry pump house and to it gravitates the overflow slurry from the kiln feed tank. In order to keep a constant head of slurry in the kiln-feed tank rather more slurry than is required for the kilns is pumped to it and the overflow is returned to the sump. By this arrangement it is possible to determine the quantity of slurry being manufactured and the quantity being pumped to the kiln.

Slurry Mixing

For the purpose of correcting and storing the slurry, six reinforced concrete tanks are provided, each 34 ft. high and 21 ft. 6 in. in diameter. Cast-iron slurry piping 6 in. in diameter, with the necessary valves, is arranged to lead the slurry direct to the sump in the slurry pump-house, from where it is pumped to the kilns. The sump contains about 770 cu. ft. of slurry. An overflow is arranged to operate at about 18 in. from the top, leading from this sump to the mill discharge sump. The overflow from the kiln-feed tanks is returned to this sump. The piping is so arranged that one or more tanks can feed slurry to this sump at speeds regulated by their respective valves.

Slurry piping 6 in. in diameter is also arranged to discharge the slurry as it comes from the pump, drawing it from the mill discharge sump. It will be noted that this arrangement allows a determination of the amount of slurry being ground by the mills. Each tank is provided with an internal lad-



One of the three raw grinding mills and, at right, two of the motors driving them

der with rungs 1 ft. apart, and at every 5 ft. on the ladders there is a distinguishing mark to enable a quick determination of the height of slurry in the tank. In this case a difference in level of 1 ft. in the slurry tanks represents 364 cu. ft., or approximately 16.7 tons of slurry, containing 36% of water, corresponding to about 10.7 tons of dry raw material. As slurry is pumped direct from the mills to one tank, it is an easy matter to estimate the quantity manufactured over a given period by watching the height of the slurry in the tanks. In a similar manner, as the slurry discharges from the tanks to a sump and as the overflow of slurry pumped from this sump to the kilns returns to the same sump, it is a simple matter, by watching the depth to which the slurry falls, to estimate the quantity of slurry being transferred to the kilns.

A seventh tank is provided for clay slurry storage. This is kept in constant agitation by compressed air. On top of the clay tank a smaller reinforced concrete clay tank, 6 ft. diam. by 7 ft. high, is situated. Clay slurry is pumped directly from the wash-mills to this small feed-tank, and the overflow falls into the main clay-storage tank. In the event of the wash-mill not working, which occurs at least once during 24 hours, an 8-in. 3-throw plunger pump similar to that used for clay and slurry service can pump clay slurry from the main clay-storage tank to the small clay-feed tank, from whence it is fed to the mills. From the small clay-feed tank a 3-in. pipe provided with the necessary valves can lead clay slurry direct to any of the six slurry tanks, thus giving the chemist additional control over the mix.

On top of one of the slurry tanks is a concrete feed-water tank which provides water for cooling purposes and for the process. It is possible to manufacture clinker without any trouble in the kilns when using up to about 50% of sea water.

The slurry is agitated by compressed air, produced by two double-acting single-stage vertical compressors direct-coupled through gearing to 75-hp. motors. Each compressor is capable of delivering 450 cu. ft. of free air per minute at a working pressure of 50 lb. per sq. in. Normally the pressure registered at the automatic valve is 40 lb. per sq. in. The air is led to a patent 12-way valve at the top of the slurry tanks. The compressed air, acting on a piston and throwing it one way or the other, operates a ratchet which controls a supply of air through twelve 2½-in. mains, two for each tank; from these mains twenty-one ¾-in. pipes pass down into each slurry tank, where they are held rigidly at the bottom, half way up the tank, and at the top. The operation of the valve is to control the supply of compressed air for agitating the slurry. First, half of one tank is agitated for a period of about four minutes, and after an interval the supply switches over to the next half-tank for a similar period. The cycle of all six slurry tanks is completed in one hour, and each tank receives two agitations during that period. In the event of one tank being empty the air mains to this tank are shut off by a valve. The valve controls the agitation of the slurry in the six tanks entirely automatically and is operated by a ¼-hp. motor. The air agitation of the clay-slurry tank is controlled by hand.

Discharge end of the two rotary kilns showing cooling cylinders

Burning

Slurry from the sump in the slurry-pump house is pumped directly to the kiln-feed tanks on top of the kiln flue. There is one tank per kiln, each 5 ft. long by 4 ft. wide by 2 ft. 9 in. deep. The slurry feed is at one end of the tank. At a distance of 3 ft. 9 in. from the slurry-feed end there is a notched division plate in the tank, and between the slurry feed and the division plate there is a baffle arrangement consisting of a wide mesh netting which insures that the head of slurry flowing over the notch is unaffected by the pulsations of slurry through the feed pipe, and stops extraneous matter which might clog the notch. The outlet of slurry is at the opposite end of the tank. An overflow of slurry is arranged between the baffle screen and the feed end of the tank, which gravitates to a flume, and the overflow is led back to the sump in the slurry-pump house. The slurry from the feed tank gravitates to a measuring pot with a capacity of 3 cu. ft. or approximately 305 lb. The pot is fitted with a plug, and when the stream of slurry fills it in 30 seconds the feed is correct for a kiln output of 6 tons per hour. The measuring pot has an overflow pipe which comes into use if the plug is left in position too long. The slurry next falls through a pipe to a conical hopper bolted directly on to the 9-in. kiln-feed pipe. The discharge from the flue-dust hopper is arranged to fall so that the stream of slurry impinges upon the falling dust and both are introduced in this way into the kiln through the feed pipe.

There are two kilns, each 240 ft. long plus the length of the recuperator; the overall length, including the recuperator, is 254 ft. The upper portion of the kiln, comprising about 150 ft., is 7 ft. 9 in. in diam. There is a decarbonating zone of 11 ft. diam., and this section, including the taper portion, is about 45 ft. long. The remainder of the kiln, consisting of the firing and cooling zones, is 9 ft. in diameter. The kiln is carried on five tires.

The motor is 60-hp., of variable speed from 360 to 720 r.p.m. By means of the variable speed motor the speeds of the kiln can be varied from one revolution in 48 seconds to one revolution in 25 seconds. In all there are eight different speeds.

Air seals of the floating type are provided at the upper end of the kiln and also at the end of the recuperator. For a distance of 70 ft. from the top end of the kiln, chains are suspended to afford additional drying area for the incoming slurry.

From the feed end of the kiln for a distance of 144 ft. the lining consists of 4 in. of ordinary high-silica fire brick. The next 20 ft. is furnished with a 5-in. lining of second quality high-alumina refractory blocks. The next 38 ft., which comprises the enlarged decarbonating zone, with the exception of the taper section at the lower end, is furnished with a 6-in. lining of second quality high-alumina blocks. The lower taper of this enlarged zone, comprising a length of 7 ft., the firing zone, and the 9-ft. diameter section of the kiln (a total of 37 ft.) are provided with 6-in. first quality aluminous lining blocks. Finally, the end taper section of the kiln and a short straight piece, comprising 8 ft. altogether, have a 6-in. aluminous lining of second quality. At the lower end of the firing zone there is a nose ring of fire brick to act as a dam to retain the outgoing clinker a little longer in the kiln. The blocks are carefully laid, using only a thin wash of cement and water.

The main body of the recuperator is 9 ft. in diam. and 14 ft. long. Equally pitched around the circumference of this cooler is a set of 12 mild steel cylinders 3 ft. 6 in. in diam. by approximately 14 ft. long, built up of ¼-in. steel plates and fitted with spiral steel lifters in interchangeable sections. The

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clinker falls through 10 outlets at the bottom end of the kiln, at which points cast steel chutes lined with heat-resisting renewable liners are riveted to the shell, and through these chutes it passes into the previously mentioned cooling cylinders. The spiral lifters in the cylinders cascade the clinker in the opposite direction and it finally leaves the cooler at the end of the cylinders, falling into a chute and thence to either of the shaker conveyors underneath. Inside the main body of the recuperator there are 10 heat-resisting cast-iron nose rings and grids over the chutes discharging into the outer cylinders.

The guaranteed output of each kiln was 1000 tons of clinker per week and the coal consumption 23% of dried coal per ton of clinker produced, the coal to be "standard" coal containing 12,600 B.t.u.'s per lb. ground to a fineness of 10% residue on the 180-mesh sieve. The slurry moisture content was not to exceed 30%, with 1.53 tons of dry raw materials to 1 ton of clinker, and the temperature of the slurry was not to be less than 60 deg. F. The performance of the kilns under test was rather better than this, as may be seen from the test sheets later.

The mixed coal is drawn from the reinforced concrete storage bunkers by means of two 48-in. feed tables of similar construction to those already described. The coal is then passed through a rotating star feeder, which acts as a check on air being blown out in this direction, and falls into the coal mills, of which two are provided. Hot air drawn from the cooler is also introduced into the feed end of the mill.

The mill is of the air-swept ball-mill type and has two compartments. Each mill is 7 ft. 3 in. diam. by 7 ft. 10 in. long. The preliminary grinding chamber is lined with special cast-steel step plates, and the finishing chamber with hard cast-iron plates. The mill is driven by a 150-hp. motor. In the primary compartment a charge consists of 36 cwt. of 3-in. balls and 18 cwt. of 2-in. 0.8 carbon-steel balls. In the finishing compartment are three tons of 1-in. hard cast-iron cylpebs and three tons of ¾-in. cylpebs. When the coal is fine enough the draught draws it up a pipe leading to a cyclone separator. In this cyclone the powdered coal falls to the bottom and thence to the boot of an elevator, after passing through a second star feeder, which again acts as an air seal. The air is drawn from the top of the cyclone and thence to the coal-firing fan. The elevators discharge the coal into two hoppers, each containing about 10 tons of powdered coal. Underneath each hopper is a double-worm feeder, 6-in. diam., with enclosed drive, and agitating gear is provided in the hoppers to prevent arching and flooding. The hot-air piping in the air-swept coal plant is lagged, and the pipe is arranged with valves so that each coal mill can run in conjunction with the other. One coal mill is guaranteed to provide sufficient coal for two kilns.

The burner has under his control on the firing platform the regulation of the notch slurry-feeder, the operating of all the dampers, and the starters and regulating gear for all the motors connected with the operation of the kiln. It is therefore unnecessary for him to leave the burning platform in order to control any part of his plant, and an arrangement of red and green lights indicates to him if there is a stoppage of slurry from the main tanks.

The gases from the kiln pass first into a brick flue, from which they can pass to a metal flue connecting with the 164 ft. by 10-ft. 9-in. diam. chimney.

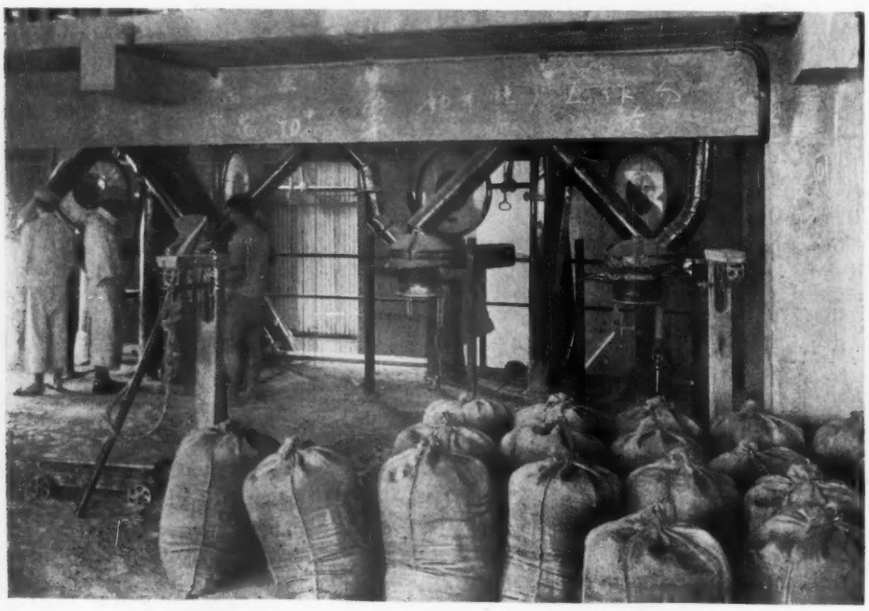
Normally, however, the gases from the kiln pass through Lodge-Cottrell electrical dust-precipitation plants, of which there is one for each kiln. The voltage used for operating the Lodge-Cottrell plant is 60,000, stepped up from the 350-volt supply by rectifiers and necessary gear in the transformer house. Behind each precipitator is an induced-draught fan directly coupled to a 60-hp. variable-speed motor, which exhausts the gases into the base of the chimney. As the dust-laden gases pass into the treater the dust is attracted to the highly charged electrodes; these are constantly rapped, and the dust falls into the hopper-shape bottom of each precipitator. Underneath each treater is a screw conveyor discharging into a conveyor under the brick flue. A certain amount of dust is deposited in the brick flue and is drawn through chutes to this conveyor. The dust is fed to the boot of an elevator which discharges it to the kiln with the slurry, as already indicated. The dust reclaimed by the Lodge-Cottrell plant, as measured over a period, is 90 lb. per ton of clinker.

The clinker from the coolers falls to one of two shaker conveyors, each of which has a capacity of 24 tons per hour. The trough of each conveyor is built up of 5-ft. lengths of ⅛-in. steel plate, stiffened on the top joints with angles and slung at intervals of 10 ft. At the delivery end of each conveyor is a tapered bar screen to allow lump material to pass on to the rolls. Each conveyor feeds a set of 24-in. by 18-in. toothed crushing rolls.

The clinker discharges into one of two enclosed vertical bucket elevators which discharge either to an automatic tipping weighing machine, as already described for coal, or into a chute which can be used to spout clinker to one end of the storage. This latter arrangement will only be used when bad clinker is suspected, or in the event of the clinker storage being full. The capacity of this weighing machine is 15 tons per hour, and room has been left to install a machine of twice this capacity at a future date should extension be deemed necessary. The weighing machine discharges to a belt conveyor, 20 in. wide by 230 ft. long, which runs over the whole length of the clinker storage and is provided with an automatic tripper; in practice, however, it is found more convenient to deposit clinker made at one time in one place.

The total capacity of the storage is about 11,000 tons. In the floor of the storage are 20 gratings and hoppers which project into a concrete tunnel under the clinker storage, where the clinker is fed to a belt conveyor 20 in. wide and 232 ft. long, which delivers it to the boot of an elevator at one end.

The elevator discharges to another belt conveyor 20 in. wide and 202 ft. long, which transfers the clinker to an automatic weighing machine of the hopper type situated above the clinker bunkers in the cement mill. This machine indicates the quantity of clinker taken from storage, while the automatic tipping weighing machine previously mentioned gives the quantity of clinker fed into storage.



Dial scales are used to weigh the 250-lb. bags

Cement Grinding

The clinker from the automatic scale is tipped on to a 24-in. conveyor and by means

of ploughs is delivered into three reinforced concrete clinker bunkers. The clinker bunkers hold 215 tons each and the gypsum bunkers 35 tons.

A 20-in. by 6-in. jaw crusher is provided on the ground floor to deal with gypsum. Gypsum is transported by hand from the dump under the ropeway to a small storage alongside the gypsum crusher. An 8-in. enclosed bucket elevator transports the gypsum to the top of the concrete bunkers, where a flat belt delivers it by adjustable ploughs to one of three small gypsum bunkers.

Under the clinker and gypsum bunkers there are 54-in. and 24-in. diam. feed tables. The clinker and gypsum is fed into three 3-compartment compound ball and tube mills, each 6 ft. 6 in. diam. and 36 ft. long. With the exception of their length these mills are identical with those provided for the raw material and are driven by the same size motor. As in the case of the raw mill, the motor house is formed under the concrete bunkers and is separated from the cement mill to avoid dust. The first chamber of each mill, which is 7 ft. 1¼ in. long, is charged with 3¼ tons of 5-in. and 3¼ tons of 4-in. steel balls. The second compartment, which is 9 ft. 1½ in. long, is charged with 4 tons of 2-in. and 4 tons of 3-in. steel balls. The finishing compartment, which as in the case of the raw mill is silex lined, is charged with 7½ tons of 1-in. and 7½ tons of ¾-in. cast-iron cylpebs. The output of each mill was guaranteed to be eight tons per hour when grinding ordinary portland cement to a 5% residue on the 180-mesh sieve. When grinding rapid-hardening cement, which the Green Island Cement Co. calls "Emeralcrete," the guaranteed output was 4.75 tons per hour when grinding to 1% residue on the 180-mesh sieve.

The cement from the mills discharges into either of two 14-in. screw conveyors, each 64 ft. long, which discharge to two 18-in. bucket elevators as already described.

It is necessary to handle the cement manufactured in the old dry-process works by the same means and to mix it with the ordinary wet-process cement and to store it in the concrete silos. Cement from the dry-process works was wheeled in specially constructed trucks which were fed directly from the tube mill to an elevator and conveyor, distributing the cement over open low bins. The cement is still wheeled from the old factory in these trucks, but they are now discharged through a specially constructed dust-reducing hopper on to an inclined belt conveyor 29 ft. long and 24 in. wide. In this way the dry-process cement is discharged into the boot of either of the 55-ft. elevators.

The two elevators discharge into two worm conveyors, 18-in. diam. by 27 ft. long, which transport the cement over the roadway between the cement mill and the cement silos and discharge it to two other bucket elevators which lift it to the top of the silos.

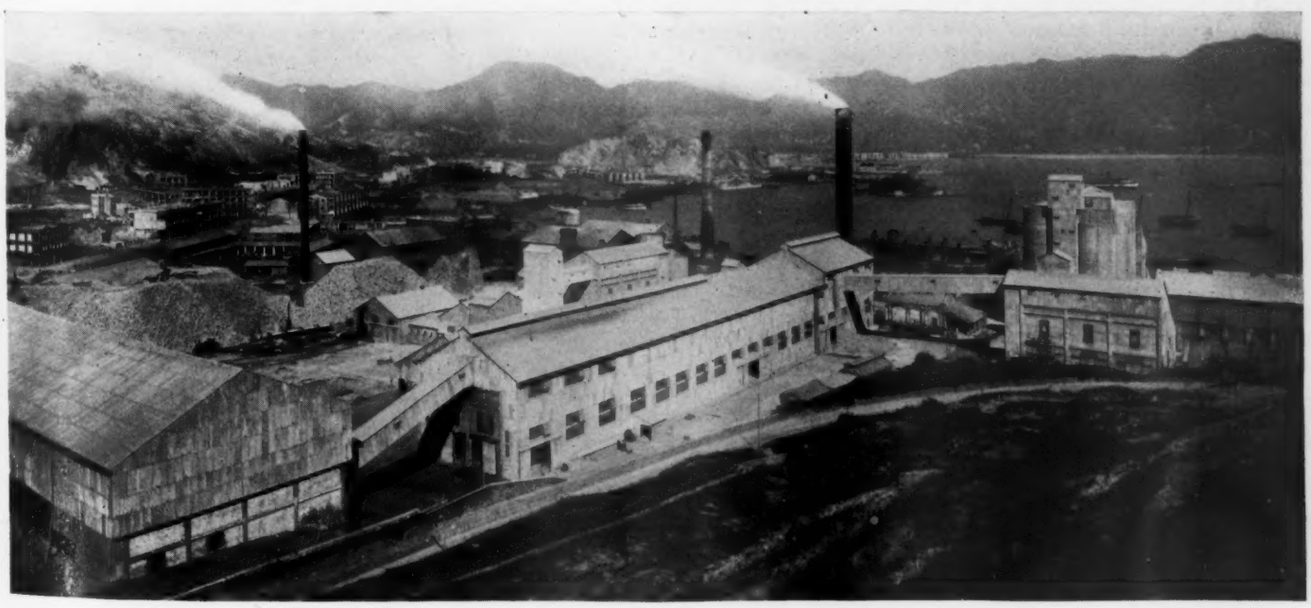
In the cement mill there is a suction bag-filter of generous capacity for collecting the dust in the mill house from each point of discharge from the clinker belt and from the clinker weighing machine.

The dust is all collected in one main flue and a second main flue takes the dust from each mill discharge and from the first pair of cement elevators. The dust-laden air is drawn through stocking filters by a fan operated by a 45-hp. motor. The dust is deposited on the inside of these filters, which are rapped by special gear; it then falls to the bottom of the filter and by means of a worm conveyor is transferred to the bulk cement passing to the silos. Owing to the extreme humidity of the Hong-Kong climate during the summer months it is necessary to heat the dust-laden air to be filtered to prevent clogging the filter with moisture.

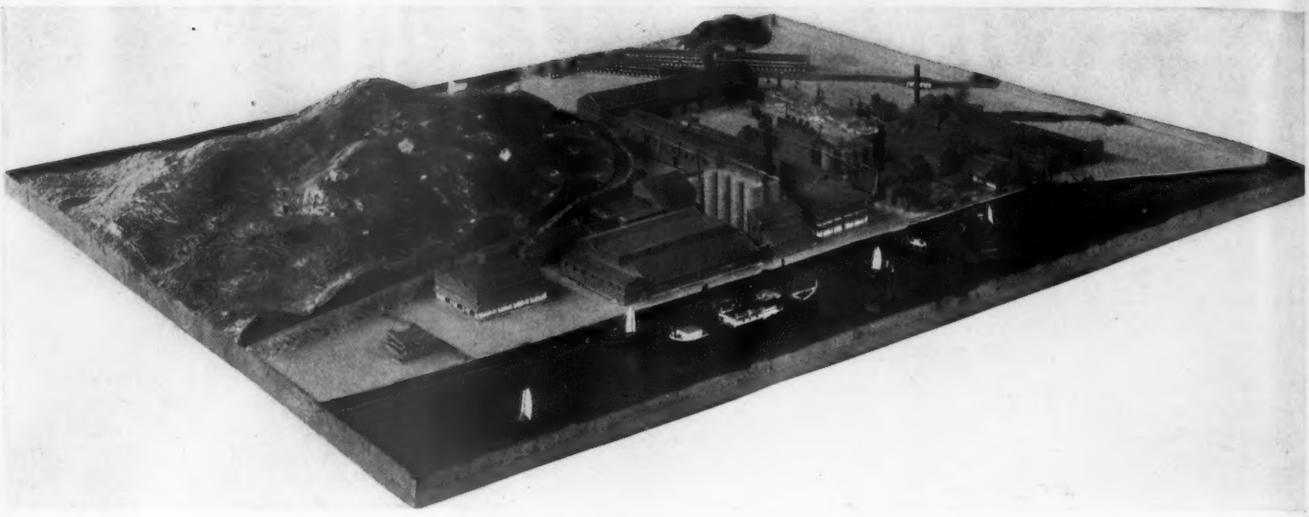
Cement Storage and Packing

Eight reinforced concrete silos 40 ft. in diam. and 80 ft. high are provided for storing cement. The bottom of the silos is "W"-shaped, with three outlets along the bottom of each "V" of the "W," making six outlets per silo in all. The extraction conveyors run in a tunnel under the center of each row of silos. One of the silos is divided into eight wedge-shaped sections, and a staircase with seven landings is provided through the center of this silo. Sampling doors are provided to each section of the silo on each landing so that it is possible for a customer to whom a bin has been allocated to take samples at seven different levels throughout the height of the bin. Each of the seven plain silos has a capacity of approximately 2100 tons, while each of the eight sections of the divided silo has a capacity of about 190 tons. The roofs of the silos are flat, and the silos are so constructed that each one is separate from the next and does not form a part of the nest. The ground upon which the silos are constructed is reclaimed, and although the reclamation took place some 33 years ago, it was necessary to drive concrete piles. On top of the piles is a heavily reinforced concrete mattress, and the silos are built on top of the mattress.

Cement from the elevators discharges to either of two 18-in. worm conveyors, 109 ft. long, running over the whole length of the silos. Each conveyor is provided with outlets to spout the cement into any of the seven plain silos. Cement can be discharged from these conveyors into a 23-ft. cross conveyor for feeding the divided silo, and this conveyor discharges into a swiveling spout which can be adjusted to feed into any one of the eight small bins. The cement conveying arrangements are duplicated throughout, not only because of standby arrangements, but because two kinds of cement, namely, ordi-



View of plant from opposite side, showing end of coal storage at left, kiln building in center and cement silos at right



Photograph of a model of the plant of the Green Island Cement Co.

nary portland and rapid-hardening portland cement, are manufactured at the same time and distributed to different bins. Under each row of four silos are two worm conveyors (making four in all), each 14-in. diam. by 130 ft. long. These conveyors run in an open concrete trough, and the top is covered with a grating. Each silo is provided with six outlets, as already described, feeding the two conveyors. The bottom of the silo is approximately 3 ft. from the top of the worm conveyor, and the iron connection between the two is provided with two cut-offs. The upper cut-off, which is near the bottom of the silo, is provided with a wheel, while the bottom one (near the top of the conveyor) is a plain slide. By having two cut-offs in this way, in the event of the cement in any silo arching up, the danger of flooding the tunnel when the arch is being poked down is minimized; a small poke-hole is provided between the two cut-offs. By running the conveyors open any cement which spills or floods the tunnel can be easily swept into the conveyor.

The four extraction conveyors feed to two cross conveyors which discharge to two bucket elevators. One elevator is situated at each end of the packing house. These elevators discharge the cement into four reinforced concrete packing hoppers of 30 tons capacity, two at each end. Under each hopper is a set of double 7-in. diam. extracting screws. From the screws, which are capable of drawing cement from the hopper at a greater rate than it can be packed by the bagging and barreling machinery, cement is returned to the cross conveyors feeding the elevators. The cement can be spouted from this extraction gear to the first floor, where bags are packed, or through to the ground floor where barrels are packed. Under each packing hopper are two sets of platform weighing machines for packing cement into bags on the first floor of the packing house. This makes eight bag-weighing machines in all. The bag used by the Green Island Cement Co. contains 250 lb. and is too large to be handled by a suitable automatic machine. On the platform of each weighing machine is a bag-holding arrangement forming part of the platform on to which the bag is clipped and suspended about 6 in. clear of the platform. A flexible spout connects the worm-extraction gear under the packing hopper to the bag, and when the operator pulls a valve in one direction cement flows into the bag and the weight is indicated on a large dial. When the dial indicates the bag contains 250 lb. the operator switches over the valve to a spout feeding a second platform machine upon which a bag is in position. While the second bag is filling a coolie inserts the nose of a sack truck under the weighed bag on the first machine and removes it, and another bag is clipped on to the machine ready for the next cycle of operations. The operator becomes skillful in deciding exactly when to switch over the supply of cement, and bags are filled with considerable accuracy by this method. One check-weighing machine is provided, and bags are frequently checked on the scales. The bags are closed by a wire tie and hook twister and sealed and delivered either into the go-down for storage or transported into lorries or lighters. The arrangement works well, and about 15 tons of cement per hour can be packed by each pair of machines, making a total of 60 tons per hour. On the ground floor are four sets of barrel-weighing machines, one for each hopper, by which the amount of cement for the barrel is weighed in a suspended machine with a large dial. The barrels contain 375 lb. of cement. This is spouted into the barrel, which is placed on a joggling machine, through a movable skirt while it is being filled. There are two joggling machines per weigher and each can deal with about 7½ tons per hour, making a total of 30 tons per hour for the four machines. The head of the cask is then rapidly put into position and the casks taken to the go-down or directly into lighters. In the packing house a dust-collecting plant of a similar type to that in the cement mill is installed and dust is collected from all the weighing machinery and returned into the conveyor.

After the packing house was in operation it became evident that there would be a demand for cement packed in paper bags. A Bates 4-valve paper bag packing machine of standard type was therefore installed on the ground floor of the packing house. The hopper was arranged to be fed through a screen by short worm conveyors from either of the cement elevators in the packing house.

Tests of the Plant

Tests on one of the crushing and conveying units showed an average output of 33 tons of stone crushed per hour with a power consumption of 1.64 kw.hr. per ton.

Tests on one of the raw wet grinding mills gave an average output of 14.37 tons of dry materials per hour with a power consumption of 28.2 kw.hr. per ton. This was to a fineness of 7.72% on 180-mesh and with an average water content of 35.5%.

Tests on one of the cement grinding mills gave an average output of 9.45 tons per hour to a fineness of 4.65% on 180-mesh, with a power consumption of 32.5 kw.hr. per ton.

The 14-ft. wash mills handled 18 tons of dry clay per hour with a power consumption of 1.44 kw.hr. per ton.

The coal grinding unit produced 3.36 tons of pulverized coal per hour with a power consumption of 25.6 kw.hr. per ton. The clinker production was 6.53 tons of clinker per hour for each kiln. The power used by the kilns and fans was 13.28 kw.hr. per ton of clinker. The coal consumption, corrected for moisture, was 22.1% of the weight of clinker. The average temperature at the feed end of the kilns was 545 deg. F. and the average temperature of the discharged clinker was 216 deg. F.

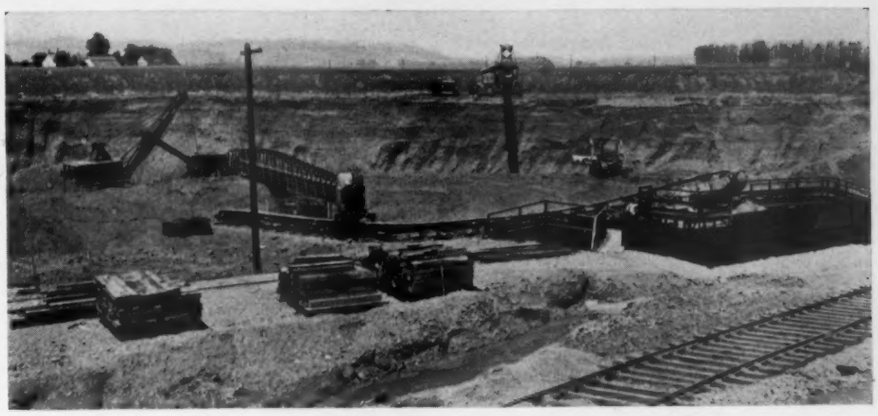
A fine grinding test on one of the cement grinding mills, with a differently arranged ball charge, resulted in grinding 5.8 tons of clinker per hour to a fineness of 0.99% on 180-mesh with a power consumption of 62 kw.hr. per ton. The temperature of the cement leaving the mill was 250 deg. F.

Developments at New California Sand and Gravel Plant

Kaiser Paving Co. at its Radum Plant Near Oakland, Calif., Changes Pit Operation to Use Belt Conveyors Instead of Cars and Adds to Crushing and Loam Handling Equipment to Make New Product

By G. F. Dodge, M.E.

THE Radum plant of the Kaiser Paving Co. in the San Francisco district was the first, so far as the writer is aware, to install equipment designed to save the fine sand down to 200 mesh, a feature that has been repeated in the design of the Hoover Dam sand and gravel plant. That the installation was justified has been proven by the preference of contractors for this sand after once having used it. In addition to giving a smoother and more workable mix, engineers have learned its value in producing a stronger concrete, and a number recognize this by permitting a reduction in cement ratio. The user benefits by better workability and a saving in cement, the producer by a preference in the market and selling a heavier sand.



New conveyor system in pit for handling gravel from shovel to plant

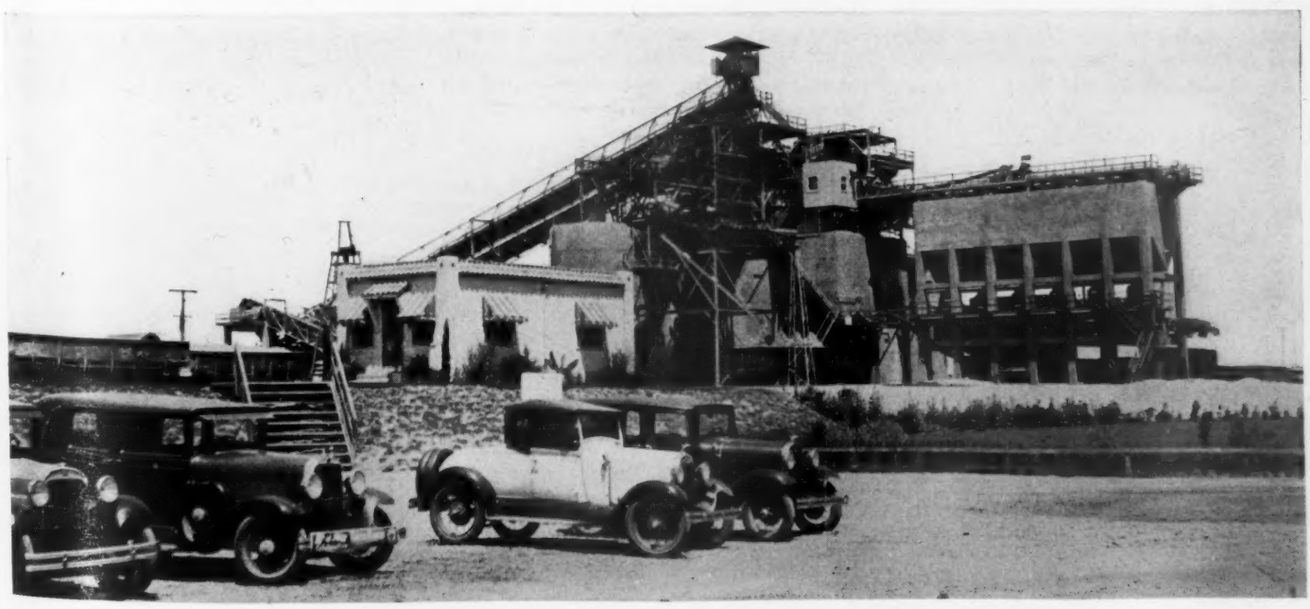
This plant, which was described in ROCK PRODUCTS, August 15, 1931, was built for a capacity of 250 tons per hour with provisions for increasing the width of some of the conveyors and duplicating a few screening units. The rate of production has been gradually increased until it now readily handles 550 tons per hour, and this with no additional equipment, simply an increase in size of a few of the motors and screening units.

In common with other producers conditions have caused the company to search for new outlets. One of these, a low priced product, but of appreciable tonnage, is "road rock" which, according to California state specifications, shall be well graded crushed material of the following composition:

90-100%	minus 1-in.
50- 70%	minus ¾-in.
35- 60%	minus 10-mesh
7- 14%	minus 200-mesh

If made from gravel, the smallest crusher feed shall be rejected by a screen ¼-in. larger than the maximum crusher product. Deficiency in 10-mesh may be supplied in the form of sand. Deficiency in 200-mesh may be supplied as dust or loam. Loam from this and neighboring deposits contains a goodly proportion of finely divided clay and therefore makes a valuable bonding material.

In the ordinary operation of the plant there is an excess of what is called No. 3 gravel, 1¼-in. to 1½-in., and pea gravel, ¼-in. to ⅝-in., large waste piles of the latter having already accumulated until its disposal has become a burden.



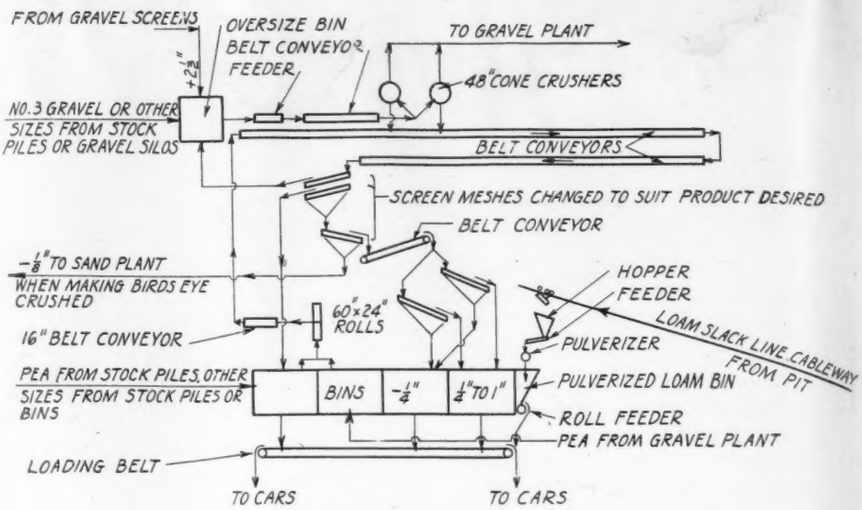
General view of plant at Radum, showing new office building in foreground

With these sizes in excess, pea gravel being almost entirely waste, and the 200-mesh material coming from the strippings, another waste material, it was not difficult to justify the installation of equipment for its reduction into this new material even though selling materially below the prices obtainable for the regular grades. Even with but a small margin of profit in itself, there were hidden profits to be expected from reduced overhead and selling expense and bringing a larger proportion of the power bill into the lower priced blocks.

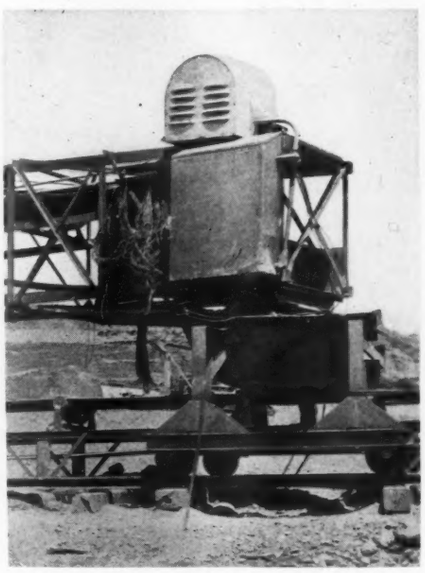
Hence, an additional 4-ft. cone crusher and a set of 60-in. by 24-in. rolls were installed, the crusher to reduce the No. 3 and other larger sizes to minus 1-in. round and the rolls to reduce the pea gravel to minus No. 3. Loam has so far been mixed in the car by means of a locomotive crane and grab-bucket but equipment is contemplated for reclaiming the strippings direct from the pit, pulverizing the clods and delivering to a separate bin, from which they would be measured by a feeder and intimately mixed with the crushed material as loaded into cars. This separate handling of loam is largely because of considerable moisture in the crushed materials which would make an unscreenable mixture if handled together. Many shipments require that it be separated into plus and minus 3-mesh.

Other outlets for crushed pea gravel are: "bird's eye" crushed, ⅛-in. to 5/16-in., and sand. As sand, however, it is not desirable in too large a proportion, as it impairs the smooth workability of natural mixtures.

To accomplish these results the crushed rock flow sheet has been revised as shown in the accompanying diagram. The oversize bin receives the plus 2½-in. from the gravel side of the plant, any oversize from the secondary crushers and also No. 3 gravel or other large sizes from the gravel silos or stockpiles by means of conveyors 3C and 3D and the tripper on the latter. Pea gravel from the fine side of the gravel plant is chuted direct to the second crushed rock bin and may also be reclaimed from stockpiles and delivered to the first crushed rock bin by the same conveyors and tripper.



Revised flow sheet of rock crushing part of plant



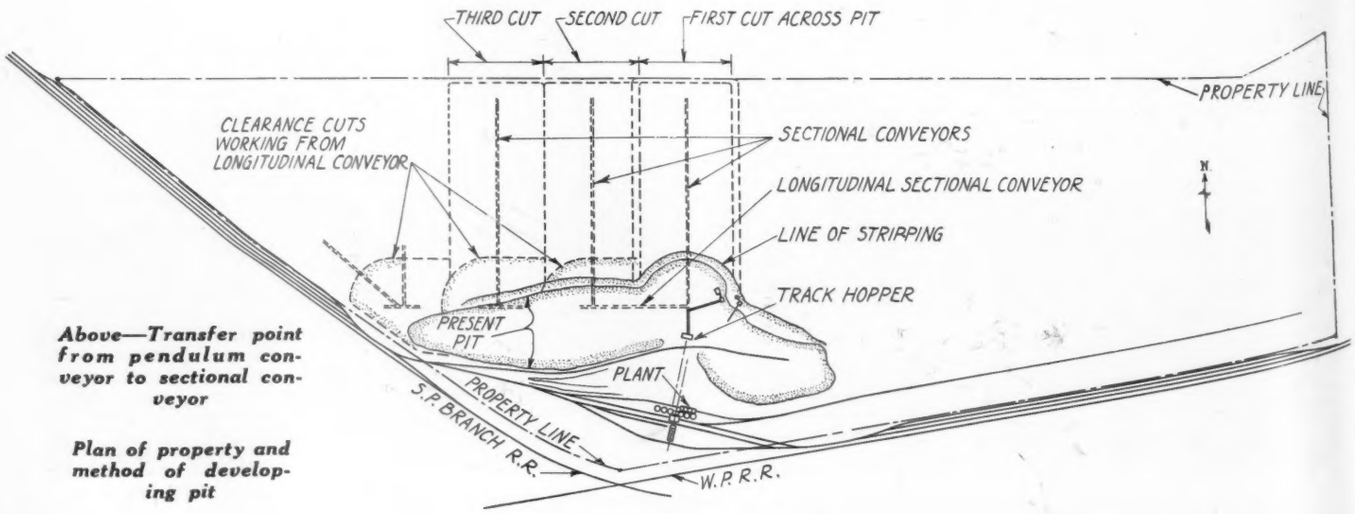
A change in the mesh of the upper deck of the first screen, removal of the bottom deck cloth, and plating over the second screen changes the plant from one making regular products to one making "road rock" with no fines going to the sand classifiers. Putting a ⅛-in. mesh cloth on the second screen sends the minus ⅛-in. to the sand classifiers and permits making "bird's-eye." Thus a short time suffices to change from one product to another. The suggested loam handling equipment is also indicated.

The additional cone crusher and the roll installation are shown in the accompanying illustrations. The roll feed chute at the left draws from the regular pea gravel bin and the one at the right from the adjoining bin that can be filled from other sources as just described. A short conveyor below the rolls delivers the roll product to the same conveyor that receives the crushed rock from the cone crushers.

Changes in Pit Operation

The development, however, that has contributed most to the greatly increased production is in the operation of the pit.

The accompanying plan shows the general outline of the property, an irregularly



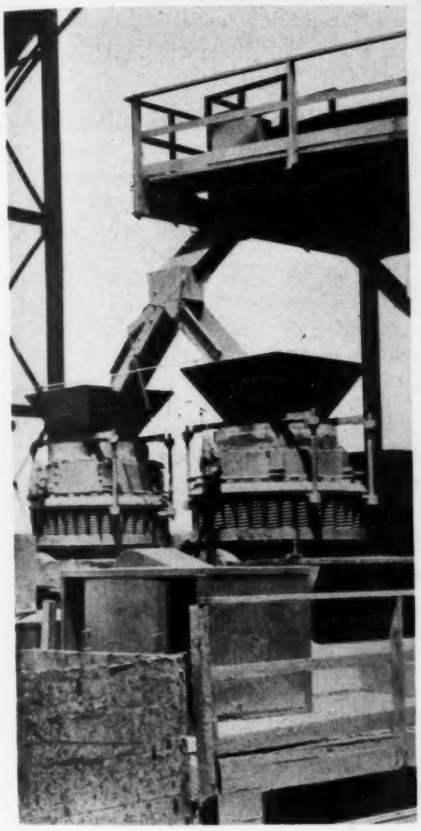
Above—Transfer point from pendulum conveyor to sectional conveyor

Plan of property and method of developing pit

shaped field of about 1600 ft. maximum width by about 5000 ft. length, the location of the plant and the approximate present outline of the pit.

A practically level gravel bed of about 31 ft. depth overlaid with an average of about 6 ft. of loam, the pit was started with a depressed track hopper, Diesel and gasoline locomotives and side dump cars.

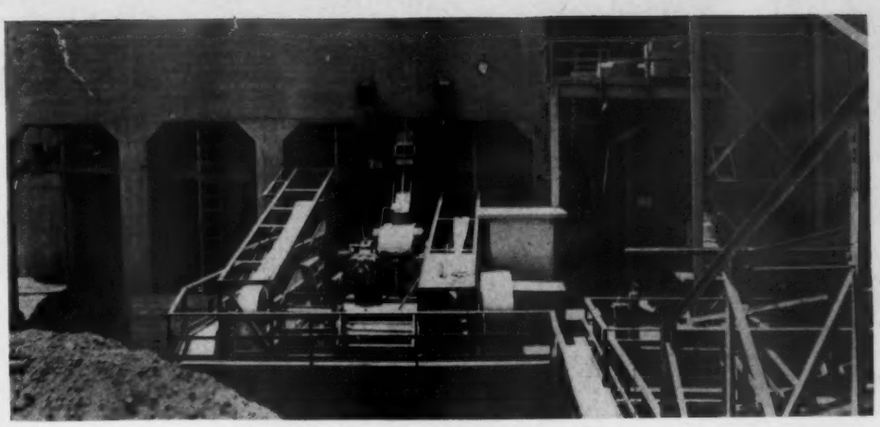
It was soon recognized, however, that delays due to track shifting, switching, etc., were a very appreciable element in pit costs, as were also oil, gasoline and labor required. Therefore studies of other means were begun with the result that late last fall after elbow room had been developed in the pit, a conveyor system was adopted which has shown pleasing results on the cost sheets.



Two cone type crushers are now used

One of the illustrations shows a general view of the conveyor system. A 150-ft. pendulum conveyor with receiving hopper and feeder serves the pit shovel and delivers to a sectional and extensible conveyor that leads up to the original pit hopper. The head of this latter conveyor was elevated some distance above the hopper level so that the hopper becomes a balancing bin of considerable capacity to iron out fluctuations in shovel operation.

These units were built in the company's own shop by arc welding and a large amount of old material was used. One of the illustrations shows how the latter was constructed at low cost from the light rails and steel ties reclaimed from the previously used track.



Additional crushing roll installation

At the same time a stripping stacker was constructed on the chassis of an old "Jumbo Fresno" and the feeder, conveyor and boom hoist were powered with a reclaimed gasoline engine.

Notwithstanding the improved pit costs, there was still one unsatisfactory feature: namely, the disposal of strippings. These had to go back into the pit where they interfered with the shovel and pendulum conveyor, the truss of which was originally straight. Further study developed the fact that by bending the pendulum truss as it now is and carrying the sectional conveyor on the fill at an elevation about 8 ft. above the pit bottom, sufficient clearance would be gained to permit the stripping stacker (with a boom overhang of about 66 ft.) to discharge waste inside the working clearance of the pendulum. With this difficulty overcome a methodical plan of operation has been adopted as indicated on the plan.

This consists of working a cut about 370 to 380 ft. wide straight across the field, then installing a sectional conveyor to the east or west the width of the cut as shown dotted, then another parallel cut across the property, repeating until that half of the field is worked out.

A shovel runner and conveyor attendant can keep a feed of 500 to 550 tons per hour going into the plant. The conveyors are 30 in. wide and the shovel is a 3-yd. electric with the dipper sides extended to take 3½ yd. or more. The pendulum conveyor hopper was constructed with wide face "Fresno" wheels without power drive. It is shifted either by a caterpillar tractor or by the shovel working as a crane.

One man with a 1½-yd. gasoline shovel and the stripping stacker can keep ahead of the pit shovel. The stacker was also built without power traverse, as the old "Fresno" chassis had none, and a caterpillar is used to move this.

Due to restricted space for strippings at present some little bulldozing of these has to be done, but as the shovel advances this will become less and in succeeding cuts should disappear. The stripping shovel operator has time to do this bulldozing and prepare the grade for the sectional conveyor which is extended for each 90 ft. to 105 ft. of advance of face.

A maximum length of conveyors of about 3500 ft. will be needed in reaching the extreme northeast corner of the field, but with the economical construction adopted and their repeated use the cost per ton will be nominal. The power cost will also be low, as antifriction idlers are used throughout and on level conveyors.

Conveyor stacker used to return stripping to pit

The Use of Limestone in the Beet Sugar Industry

By A. M. Turner, E. M.
Former Chemist, Great Western Sugar Co., Denver, Colo.

THE IMPORTANCE of the beet sugar industry as a market for limestone may be better realized when it is understood that for every pound of beet sugar produced, slightly more than half a pound of limestone is used in the manufacturing process. Last year the world's beet sugar production amounted to approximately 9 million tons, which accounted for the use of more than 4½ million tons of limestone. Of the above sugar production the United States manufactured close to one million tons. The heaviest beet producing states are: Colorado, Nebraska, Wyoming, Ohio, Michigan, Wisconsin, Montana, Idaho, Utah, and California.

Many limestone producers may not have had the good fortune to visit beet sugar factories, or become familiar with the importance of limestone as used in this great industry, so in the following narrative are described the fundamental principles involved in the manufacture of sugar and a detailed description of the part limestone plays in the process.

Through the courtesy of the Great Western Sugar Co., Denver, Colo., permission was granted the writer to secure pictures of its property for publication in Rock Products. E. K. Hulleat, chief chemist of the company's Ft. Morgan, Colo., factory, very kindly lent his cooperation, and through his expert advice it was made possible to secure much of the following data.

Conversion of Beets to Sugar

Sugar beets are stacked in huge piles near one end of the factory, and under these piles are a series of flumes into which the beets may be fed and floated into the factory where they are processed. A water bath in which the beets are agitated thoroughly cleans the roots before they are sliced into noodle-like "chips" called cossettes. The cossettes are placed in a battery of diffusion cells, where, by a continuous water leaching process the sugar from the cossette is diffused through the beet cell walls into solution and the remaining pulp is wet siloed or dried to be sold for stock feed.

The diffusion juice, as the sugar solution is called, is next taken to a carbonation tank where hydrated lime (or saccharate milk, which will be described later) and carbon dioxide (CO_2) are added. Suffice it to say at this time that the result accomplished in the carbonation tank is to precipitate with the calcium carbonate ($CaCO_3$), organic impurities contained in the beet juice. The mixture from the tank is filtered through 16-mesh duck by means of filter presses, and the filtrate is again carbonated and filtered to further eliminate impurities and reduce the alkalinity of the sugar juice to a more neutral state.

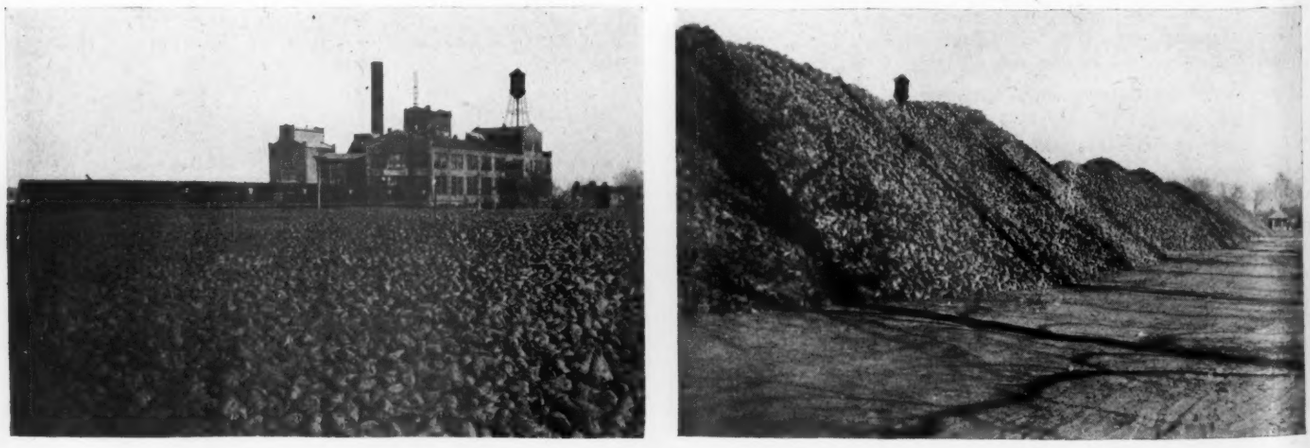
The juice from the second filter is run into a tank and treated with sulphur dioxide (SO_2) gas to further reduce alkalinity, as well as bleach the juice to a more desirable color for sugar manufacture. After again filtering, the juice is put through a series of evaporators in which the excess water is driven off by being boiled under vacuum. The concentrated juice is drawn to another tank where the remelt sugar is added to it and the mixture again treated with sulphur dioxide (SO_2) gas. After this treatment it is heated to about 95 deg. C. and sent through the thick juice filters, then pumped to the pan floor tanks from which it is fed as needed to a large vessel called a pan, where further heat treatment under vacuum causes sugar to separate as crystals which continue to grow in the mother liquor until the pan is filled.

The product formed by the last treatment is called white massecuite and is sent to the centrifugals where the mother liquor is spun out by centrifugal force leaving the white sugar crystals. The sugar is then discharged from the centrifugals, put through rotary dryers called granulators, and then sacked as a finished product, 99.9% pure sucrose.

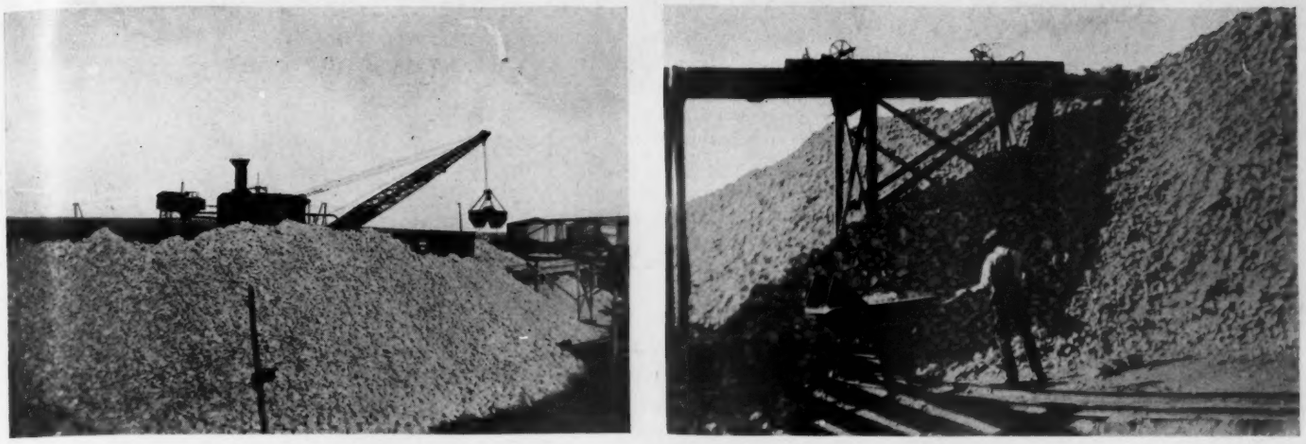
The mother liquor which has been separated from the sugar crystals by the centrifugals is reboiled with thick juice and melted sugar in successive pans as described, until all the sugar which will crystallize has been removed. The liquor which has finally become exhausted of its power to form crystals is called molasses or low

Editor's Note

***THIS ARTICLE** is of general interest to limestone and lime producers, not only because it describes clearly the use and functions of limestone and lime in beet sugar manufacture, but because it describes the process of burning lime to obtain the largest amount of carbon dioxide possible. With the growing interest in solid carbon dioxide (dry ice) this is of particular interest and value.— The Editor.*



Two views of beet pile 18 ft. deep and containing 45,000 tons of beets



Two views of stock pile of limestone to be used in sugar manufacture

green, and is sent to the Steffens house where a large part of the sugar in solution is recovered by the Steffens process, a process which takes advantage of the fact that, under suitable conditions, lime and sugar will unite to form an insoluble compound composed of three molecules of lime and one of sugar.

In order that the sugar may be extracted from the molasses, which is high in non-sugars, the use of lime is thus employed. The molasses is diluted and run into a tank called a cooler. Finely ground calcium oxide (CaO) is also slowly added to this tank and the two are intimately mixed. The mixture which is kept cold—about 20 deg. C.—results in the formation, as a precipitate, of tri-calcium-saccharate ($C_{12}H_{22}O_{11}\cdot 3CaO$) from which the sugar may be readily separated by the use of carbon dioxide gas (Co_2).

Treatment of Limestone

Having described in a general way the processes involved in the manufacture of beet sugar I shall now discuss in detail the very important part played by limestone in the sugar industry.

Sugar companies often operate their own quarries, and usually work the year around even though the factories' campaign season is about 100 days out of a year (the period required to produce sugar from the beets harvested each year is called a campaign). In the past, Rock Products has published important data about methods of limestone quarrying, so it is unnecessary to go into details of these operations. It is sufficient to say that sugar factories desire a rather definite, uniform size of rock for their kilns, usually 6 to 8 in. in diameter, and a rock of high quality, as free as possible from impurities, of which silica and magnesium are the most objectionable. It should contain at least 97% calcium carbonate.

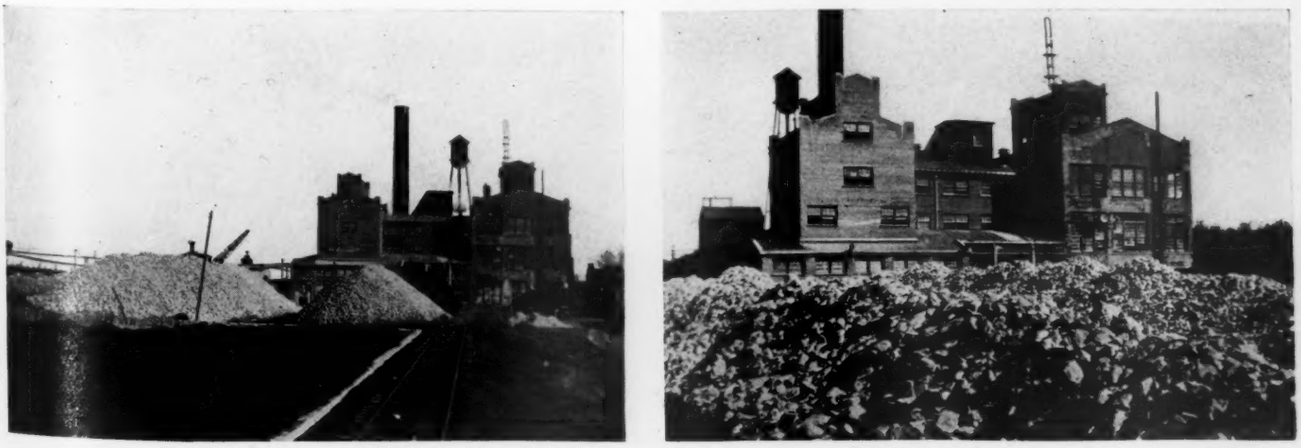
Prior to the sugar campaign, a large supply of limestone is put in stock piles at the factories. This, in addition to that which is supplied while the factory is in operation, is regulated to give a sufficient supply to take care of the work. When conditions permit, the rock is unloaded from an overhead railroad highline by means of bottom-dump cars. Otherwise clamshell cranes are employed to unload and pile the stone.

The accompanying flow sheet illustrates the steps commonly used in the sugar industry for treating the mineral and shows the part it plays in the sugar manufacturing process.

From the stock pile the limestone is loaded into small dump cars which hold about 1000 lb. The men who do the loading also break the larger pieces of rock to the desired size. The loaded cars are weighed and their contents dumped into a skip which feeds the kiln. Coke, used for fuel, and to furnish additional carbon dioxide gas, is loaded in wheel-barrows, weighed and dumped into the skip with the lime, to feed the kiln. The usual proportion of limestone to coke is roughly 10 to 1.

The shape of the kiln is that of two truncated cones with the large ends or bases joined together; the lower cone is generally much shorter than the upper one and also has considerably more slope. This shell or steel jacket is lined with a wall of firebrick. At the bottom of the kiln are movable bars or grates through which the burned lime is shaken down as needed, while at the top a pipe the same size as the top opening extends several feet into the chamber, and it is through this that the charges of coke and stone are fed. The kiln is kept full at all times by charging an amount of new material equivalent to the amount necessary to replace that which is drawn off whenever the grates are shaken.

The products formed by burning limestone with coke are: calcium oxide (CaO) and carbon dioxide (CO_2) and both are equally important for use in the manufacture of sugar. Carbon dioxide (CO_2) gas



Two additional views of limestone stock pile showing sugar factory beyond

Cars in which limestone is moved from stock pile to skip at kiln

is taken from the kiln through two pipes placed in the upper section of the chamber, in such a position that their openings lie midway between the large pipe which extends down from the top of the kiln and the sides. The gas is sucked out by means of a fan, washed while passing through a spray of water, and then compressed for use as required.

As indicated on the flow sheet, the burned lime (CaO) from the kiln is crushed by a gyratory crusher, reduced to a powder (preferably minus 200-mesh) in Raymond mills, passed through the cyclone separator where the grit is removed from the powdered lime and sent to a storage bin. From this bin the lime dust is conveyed to scales and weighed, prior to its introduction into the cooler where it is mixed with the diluted molasses.

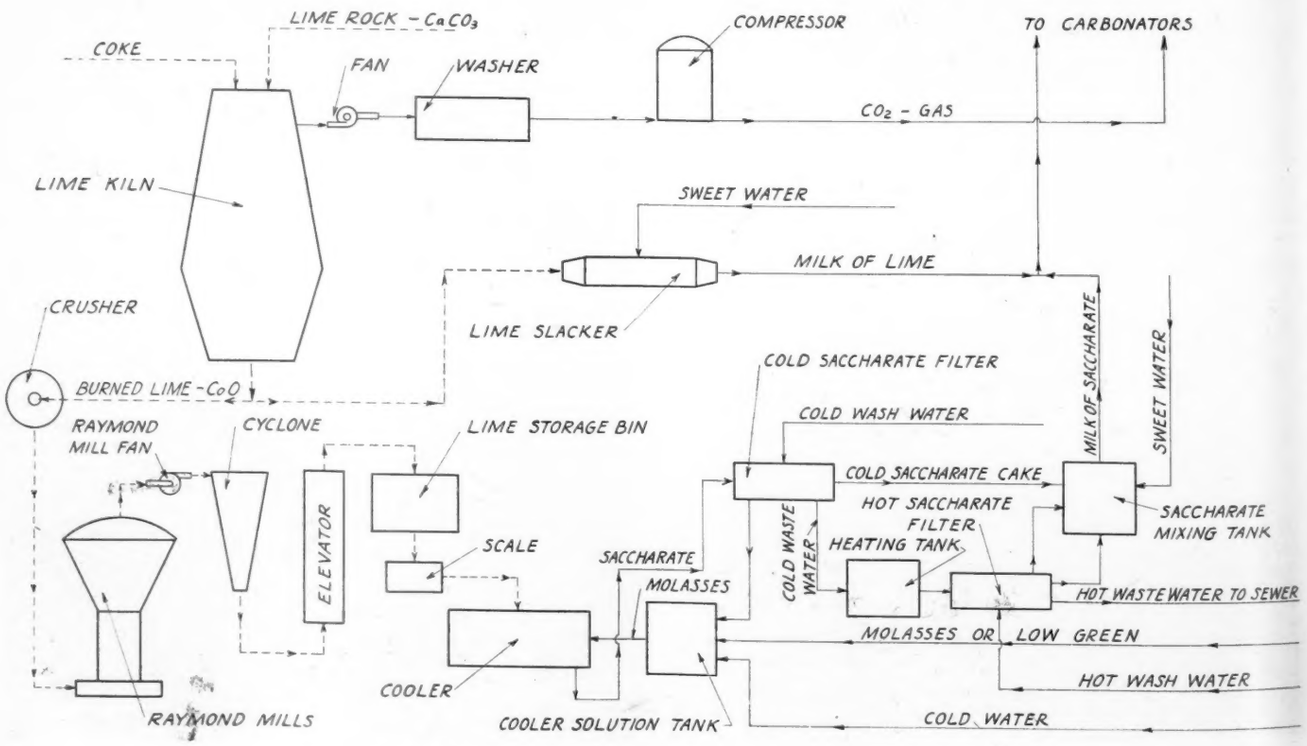
Use of Lime in Process

So far I have followed two distinct processes. The first deals with the treatment of sugar beets, and follows the process until a point is reached where molasses, which must be further treated to extract the remaining sugar, is obtained. The second part of the foregoing description deals with processing limestone in such a way that powdered calcium oxide and carbon dioxide gas are formed as agents to be used in the sugar industry.

These products (powdered lime (CaO), carbon dioxide (CO_2), and molasses) are now brought together and undergo chemical changes which are of prime importance in sugar manufacture. A definite amount of cooled diluted molasses enters a tank and is there intimately mixed with a definite weight of powdered calcium oxide (CaO), between 100 and 110% on sugar. The sugar from the molasses is precipitated in the form of tri-calcium-saccharate ($C_{12}H_{22}O_{11}\cdot 3CaO$) and the impurities remain in solution.

After the sugar has been precipitated as a saccharate in the coolers the next step is the separation of the insoluble saccharate from the waste waters containing the impurities, which is accomplished by the use of filters. Types commonly used are: Plate and frame presses, Kelley presses, and vacuum filters, either drum or disc type. The filtrate from this process still contains some sugar, and this may be precipitated as complex saccharates by heating the cold solution to a temperature of 85 deg. C. The hot solution with its precipitated saccharates is then filtered in a similar manner to that in which the cold solution was treated, or,

Section of factory containing lime kiln



Flow sheet of sugar factory showing how lime is used

Corner of control laboratory with polariscope dark room at right

which is usually the case, is sent to the Dorr thickener where the heavy precipitate settles out as a sludge and is pumped to the hot filters, while the overflow containing most of the non-sugars in solution is run to the sewer.

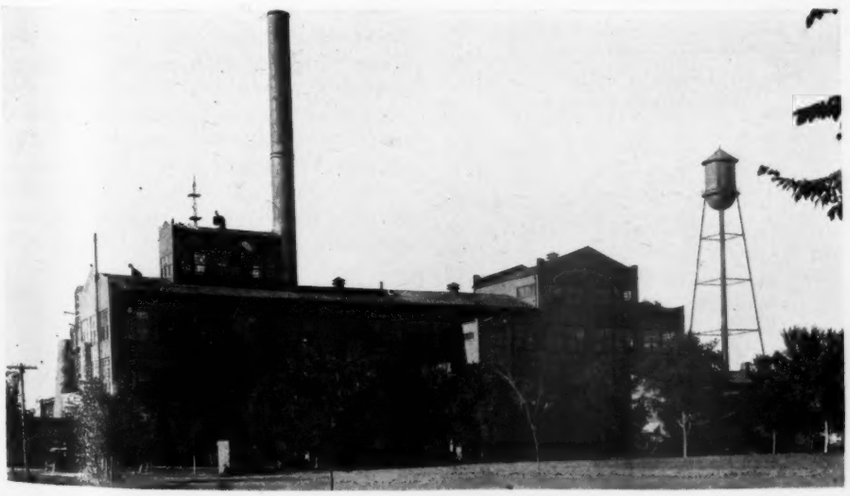
Both the hot and cold saccharate cakes or precipitates are collected in the same tank where sweet water, the thin juice which is the result of washing the remaining sugar from the cake in the first saturation filters, is mixed with it. This mixture is called saccharate milk and, as previously mentioned, is added to the carbonation tanks where its sugar content, which goes into solution, is recovered, and the lime acts as a purifier of the raw beet juice. At practically the same time that saccharate milk (or milk of lime in the absence of a Steffens unit), is added to the juice which has been extracted from the beets, carbon dioxide (CO_2) gas is bubbled through the solution.

The natural chemical reaction, of course, is that the calcium hydroxide ($Ca(OH)_2$) and carbon dioxide (CO_2) combine to form calcium carbonate ($CaCO_3$) or $Ca(OH)_2 + CO_2 = CaCO_3 + H_2O$. In the formation of this precipitate, impurities from the beet juice are collected by physical and chemical combinations. The mixture from the first carbonation tank is filtered and the precipitate, after being washed with 100-200% hot water, is sent to the sewer. The filtrate is heated and sent to the second carbonation tank where it is treated in a manner similar to that of the first carbonation, thus removing any remaining impurities that can be removed by carbonation. The purified juice then travels the course outlined in the first part of this description. As much sugar as possible is crystallized, and that which remains in solution with impurities returns as molasses for treatment with calcium oxide (CaO) as before discussed.

To emphasize the very important part played by lime in the beet sugar industry, it must be realized that the molasses produced by a sugar plant is of no small significance in quantity and that more than half of this molasses by actual weight is sugar. Due to the accumulation of non-sugars this sugar cannot be extracted in crystallized form until the concentration of impurities is reduced. One pound of non-sugars will keep one-and-one half pounds of sugar from crystallizing, so it is essential to not only control the introduction of the impurity salts from the beets into the sugar end, but also to actually eliminate these non-sugars when they have accumulated to the extent shown above.

The most commonly used method of elimination, and one might say, the only economically practical method is by the process mentioned above which was perfected by Steffens. This process is essentially one in which lime plays the leading role. Without lime in abundance and economically obtained, no Steffens process would be possible, and sugar manufacturers would be compelled to be satisfied with a relatively low percentage of extraction, which would naturally increase the cost of making sugar.

It is easy to realize from this brief general description of the manufacture of sugar that the use of limestone considered from the standpoint of volume used and the economical purpose it serves, is of paramount importance in the sugar industry, which in turn reverts to each individual who consumes sugar.



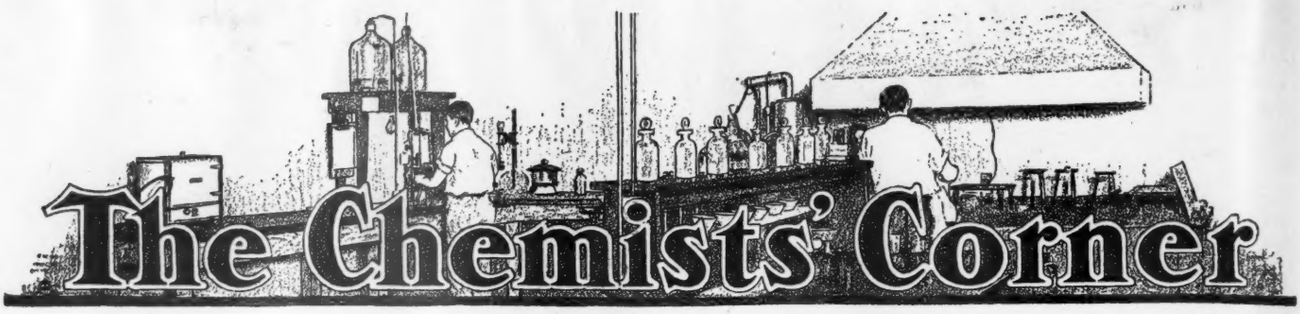
General view of plant of Great Western Sugar Co., Ft. Morgan, Colo.

Proceedings of Highway Research Board

THE PROCEEDINGS of the 11th annual meeting of the Highway Research Board held at Washington, D. C., in December, 1931, have been published. Part I, which is now available, contains reports of research committees and papers presented at the meeting. A considerable portion of the report is devoted to materials and construction. Included in this is a report on the effect of hot cement on time of set and workability of concrete by H. S. Mattimore, with a discussion; on the resistance of concrete as affected by the water-cement ratio by F. H. Jackson; a report of the committee on correlation of research in mineral aggregates by W. J. Emmons, and the significance of freezing and thawing and sodium sulfate tests of aggregates by W. V. McCown.

Spreading and Finishing Bituminous Surfaces

A BULLETIN, No. 29, "Equipment for Spreading and Finishing Bituminous Pavement Surfaces," has been issued by the American Road Builders Association. It gives recent practical developments in design and construction of asphalt pavements as reported at the annual meeting of the association held at Detroit early in 1932.



Heat Developed by Cement While Setting and Hardening

By S. L. Meyers
Chief Chemist, Southwestern Portland Cement Co., El Paso, Texas

IN THE GENERAL USE of concrete any heat generated by hydration of the cement is quickly dissipated by radiation, conduction, and water evaporation. So little does the temperature of small masses of concrete rise while setting and hardening that danger of freezing is present with temperatures only a few degrees below 32 deg. F. However, when the mass of concrete becomes relatively large compared to its total surface area then the center of the concrete may reach a considerable temperature.

Some of the factors influencing the degree of temperature rise in concrete are:

Shape and size of the concrete mass.
Quantity of mixing water used.
Richness of the mix.
Heat conductivity of the concrete.
Temperature of air and ground in contact with the concrete.
Rate of evaporation of water from the concrete.
Length of time taken to place the concrete.
Specific heat of the aggregates used and the specific heat of the cement paste with any excess water that may be present.
Heat generating capacity of the cement used and its rate of hydration.

These last mentioned properties of the cement depend to some extent upon its chemical analysis and mineral composition, particle size, and degree of aging before using in concrete. They also depend upon some of the conditions which the concrete may itself impose.

Source of Heat Generated

When cement is gaged with water a small quantity of heat is liberated due to surface wetting, and during hydration a small amount may be liberated due to surface change; but these are negligible quantities. Practically all of the heat developed is due to chemical action of water on the cement minerals.

Of the four chief minerals in portland cement, tricalcium aluminate develops the most heat during hydration. Thorvaldson and Brown[1] report 214 calories per gram of tricalcium aluminate in hydrating to the hexa hydrate, and as much as 261 calories per gram for $3CaO\ Al_2O_3 \cdot 11H_2O$.

No data was available for the heat of hydration of calcium ferro aluminate. Some tests made by the writer by dissolving both the anhydrous and hydrated compound in hydrochloric acid and comparing the heats of solution indicated that the heat of hydration of $4CaO \cdot Al_2O_3 \cdot Fe_2O_3 \cdot 5H_2O$ is 145 calories per gram of anhydrous calcium ferro aluminate. The heat of hydrolysis of tricalcium silicate and of dicalcium silicate was calculated from Richard's figures for the heat of formation of the silicates and the heat of hydration of the liberated lime. The difference of heat of formation between the higher and lower calcium silicates being subtracted from the heat of hydration of lime. For the hydrolysis of tri to dicalcium silicates this amounts to 65 calories per gram of tricalcium silicates. For the hydrolysis of dicalcium silicate to monocalcium silicates it amounts to 27 calories per gram of dicalcium silicate. These figures do not take into account any heat which may be liberated by the direct addition of water, and for this reason are no doubt too low.

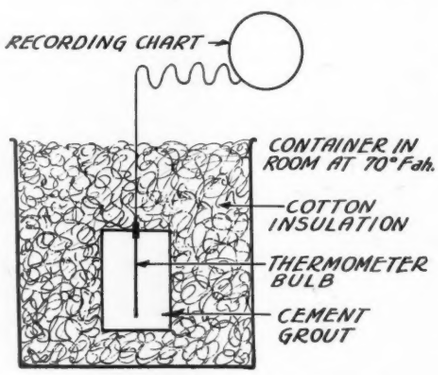


Fig. 1. Manner in which heat of hydration was measured

Rate of Heat Generation by Hydration

The rate of heat generation for each compound should be proportional to its rate of hydration while in the same state. For the case of tricalcium silicate each molecule should liberate the same quantity of heat in hydrolyzing to dicalcium, but the product will have a different quantity of heat liberated on further hydration.

The rate of hydration of cement is a very complex subject, as a great many factors are involved. Each mineral constituent has a different rate. Of the pure compounds Klein and Phillips[2] have shown that tricalcium aluminate hydrates very rapidly; that tricalcium silicate hydrates next and that dicalcium silicate hydrates very slowly.

Particle size plays a prominent part in hydration, as the water can only reach the minerals through their surfaces. The finer particles with a relatively large surface are hydrated more rapidly than the coarser ones. Clinker crystals are extremely minute. A crystal of fast hydrating material may be surrounded by crystals of slow hydrating material which prevent access of water and delay the hydration of the fast hydrating crystal. Anderegg and Hubbell[3] have shown that a cement whose particles have a mean dimension of 16.53 microns had hydrated 17.1% at 24 hours, while a cement of 63.33 microns average particle size had only hydrated 6.0%.

In mass concrete where internal temperatures are developed, a finely ground cement not only hydrates faster because of greater surface but the faster hydration develops heat more rapidly which in turn again hastens hydration.

Water may effect rate of hydration and

hydrolysis in two ways. An increase of water increases the mass of the reacting substances and hastens the reaction by mass action, it also takes into solution one of the products of the reaction and again hastens it. Work and Lasseter[4] have treated the three major cement compounds with different percentages of water and found in nearly all cases that increasing the water content increased the degree of hydration.

Where concrete is subject to water seepage and the soluble products of reaction such as calcium hydroxide are removed, the hydration reactions will go to completion and the cement residue will consist mainly of hydrated silica, and insoluble salts caused by the interaction of cement compounds and soluble salts introduced by the water.

Lerch and Bogue[5] have shown that each of the three major cement compounds will undergo hydrolysis until equilibrium corresponding to a definite hydrogen ion concentration for each mineral is reached, and that if the hydrogen ion concentration is kept below that definite pH by removal of the liberated $Ca(OH)_2$ then the reaction will proceed to completion and the products will be hydrated silica, alumina, iron and lime.

"If the products are not removed, hydrolysis will proceed to the formation of $Ca(OH)_2$ and a less basic silicate, aluminate or ferrate. The composition of the end products in this case will be determined by OH ion concentration and the amount of available water. In the presence of a large amount of saturated lime water, the silicates seem to go largely to a composition which may be represented by $CaO \cdot SiO_2 \cdot Aq.$, and the aluminates to a composition $3CaO \cdot Al_2O_3 \cdot Aq.$"

Hydration of $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$

Very little definite data seems to be available on the hydration of calcium ferro aluminate; in fact, it is only recently that this compound was recognized. In 1928, in Paper 13 of the P. C. A. Fellowship, its position in the system calcium aluminum ferric oxide is shown and some of its optical properties given. In most investigations on cement where iron is considered it is assumed to be in the form of dicalcium ferrite, and where synthetic cement compounds have been used iron was usually introduced in that form. Lately the impression seems to be that, in hydrating, calcium ferro aluminate hydrolyzes to ferric hydroxide and tricalcium aluminate. The writer's experiments on this compound indicate that practically all of the hydration occurs within a few hours after gaging with water.

In most concrete we do not have an excess of water, except for a short period after pouring, and much concrete is only partly hydrated. The writer has made tests of concrete which had aged for ten years in a relatively dry atmosphere. These tests showed that less than half of the silicates present had changed to monocalcium silicates; even test pieces of all flour cement stored in water did not show complete hydration after 18 months.

Colony[6] has shown that concrete in a 40-year-old bridge still contains all three major components of cement. He also shows microphotographs in which occasional crystals of tricalcium silicate can be seen.

Whereas ordinarily an increase of water may hasten hydration, the opposite effect may occur in mass concrete because of the high specific heat of water, which increases the heat capacity of the concrete, slowing down temperature rise and retarding hydration.

Effect of Surface Variation and Prehydration on Heat Generation

The thermal expansion of large masses of concrete is objectionable, since shrinkage accompanies the later cooling of the concrete to mean atmospheric temperature, and for this reason a cement is preferred which does not liberate a great deal of heat while hardening. It is known that coarse grinding and partial hydrating previous to mixing in concrete appear to lower the temperature rise; so these tests were made to see if this would hold true for large masses of concrete where the radiation loss is small compared to the mass of the concrete and where hydration has proceeded to monocalcium silicate·Aq.

One series of cements was made, noted H-8, H-9, H-10, and H-11 (from laboratory numbers) in which the water content was increased as the numbers rise. H-11 contained all the water the cement would absorb and still not cake on standing, the theory being that the aluminate would hydrate first and that the strength would not be seriously impaired, as insufficient water would be added to hydrate the silicates.

Another series of cements was made, noted H-12, H-13, and H-15, in which H-12 consisted of practically all fine or flour particles, H-13 of ordinary fineness, and H-15 ground very coarse.

Fig. 1 shows the manner in which the cement was hydrated. 16.64 lb. of cement and 6.46 lb. of water were brought to 70 deg. C., mixed, and placed inside 6x12-in. tin cylinders which were air- and water-tight except for a hole to introduce the grout. This hole was then sealed by introducing a recording thermometer bulb, with a proper gasket. The object of sealing the whole mass of grout in the container was to prevent any water evaporation, as some of the temperatures attained were above the boiling point of water. The can containing the grout and thermometer was then placed inside of several cubic feet of cotton which is an excellent heat insulating medium. The temperatures developed within the grout were automatically recorded on a chart attached to a clock.

The heat curves obtained are typical of neat cement grouts; there is a small rise of temperature immediately after mixing, probably due to surface wetting and the small amount of free lime which might be present in a form readily available for hydration. The maximum temperatures are attained in a few hours and from then on the radiation loss is greater than heat developed and the temperature curve falls.

In a large concrete mass it may require months to attain the maximum temperature. The reason why a small mass of insulated neat grout, with only a little more water present than necessary for its complete hydration hydrates and attains a high temperature more rapidly than a large mass of concrete is because the concrete is relatively lean in cement and for a unit quantity of cement present has many units of inert aggregate with a capacity for absorbing heat. Therefore the temperature rise is slow and hydration is not much hastened by rising temperatures. In a neat grout of the type described where a fair amount of insulation is used the heat generated quickly raises the temperature of the paste, this in turn aids hydration and the circle continues.

Chart I shows that the addition of water to cement before gaging with water slows down the rise of temperature and the maximum temperature is not as high as with cements containing lesser amounts of water. Table I shows that free moisture increased with added water, indicating that dry cements do not readily take up large amounts of added water; even after several months H-11 contained considerable free moisture. The slight increase of free lime with added water indicates that a very small amount of silicates hydrated.

Table II shows that the added water was detrimental to the strength tests except for H-9, in which case the small amount of water added did not seem to hurt either the tensile or compressive strength. The strength results in Table II are made on 1:3 sand specimens stored at 70 deg. F. and as Davis and Trotell[7] point out: "The compressive strength of a given concrete cured at normal temperatures is no indication of the compressive strength of a concrete of identical materials in a mass of proportions sufficiently large to retain the heat of hydration and to substantially increase the temperature above normal."

This, of course, is true to even a greater extent where the materials used are not identical and is probably equally true for tensile strength and compressive strength. So the fact that H-11 and H-15 developed such comparatively poor strengths under normal conditions of testing should not be held against them for use in concrete where higher temperatures are developed while hardening.

Condition of Grouts After Three Days Hot Hydration

After three days hydration the hardened grouts were removed from their containers, ground, dried at 100 deg. C. to stop further action and analyzed; their analyses and cal-

culated mineral combinations appear in Table III.

The quantity of free lime liberated indicates the degree of hydration of tricalcium silicates. A slow rate of hydration of dicalcium silicates is assumed. Where three forms of calcium silicates are present they can not be calculated as in the case of two by alloting to the other acid constituents the requisite amount of lime, then proportioning the remainder of the lime between the tri and dicalcium silicates to satisfy the available silica. Hence, this part of the tests and calculations of compounds is rather unsatisfactory.

It is also assumed that the tricalcium aluminates and calcium ferro aluminates have the same degree of hydration as the tricalcium silicates. This is probable, but open to some doubt.

Chart II shows the time-temperature curves for the fineness or surface series of cements.

H-12 is a very fine cement made by separating out the fines while grinding. As was to be expected, it attained the highest temperature of any of the grouts. H-15, a

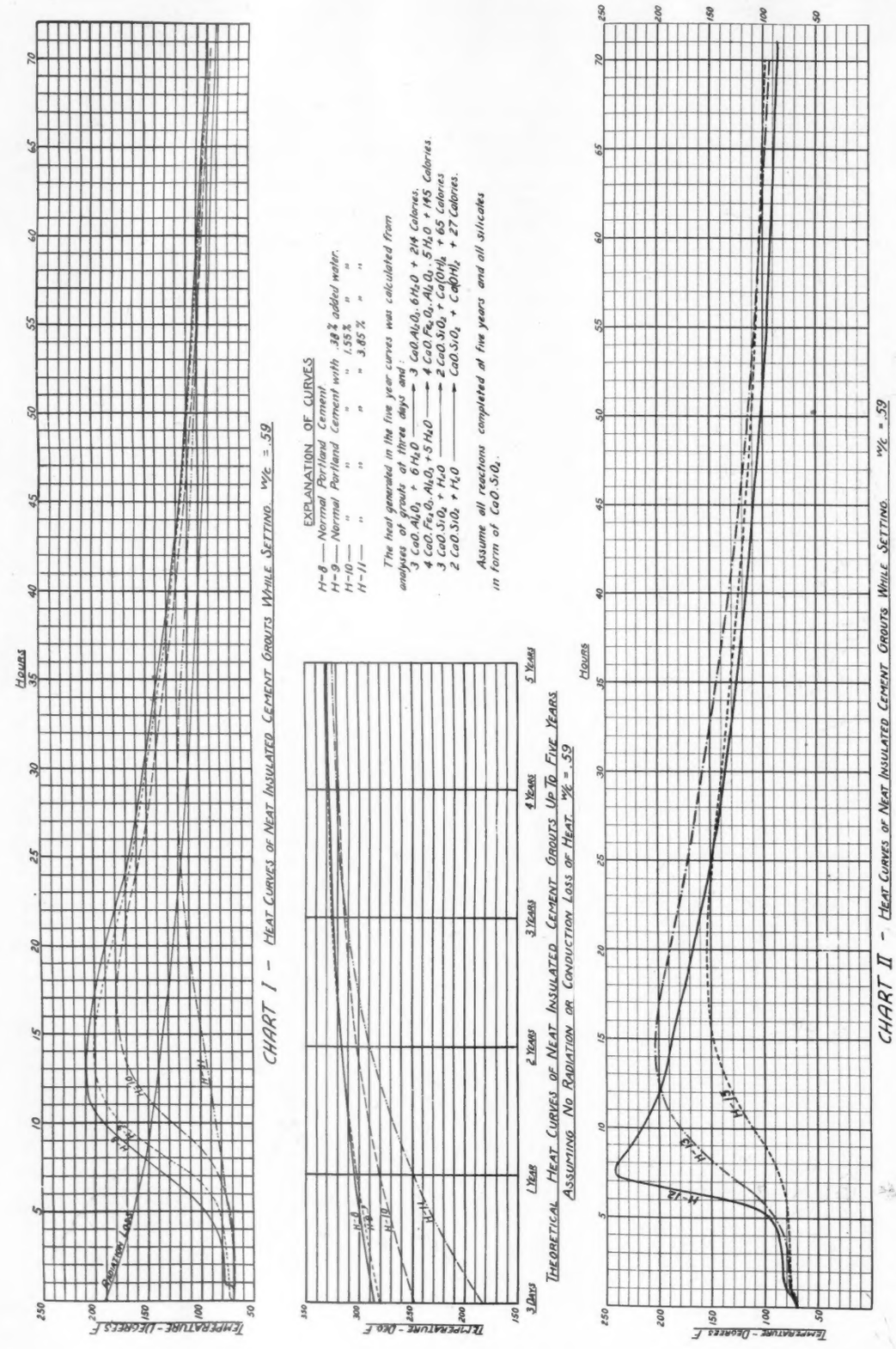


CHART I - Heat Curves of Neat Insulated Cement Grouts While Setting. W/C = .59
Hours
Temperature - Degrees F
Radiation Loss
H-8
H-9
H-10
H-11
EXPLANATION OF CURVES
H-8 — Normal Portland Cement
H-9 — Normal Portland Cement with .38% added water.
H-10 — " " " " 1.55% " "
H-11 — " " " " 3.85% " "
The heat generated in the five year curves was calculated from analyses of grouts at three days and:
3 CaO.Al2O3 + 6 H2O ——→ 3 CaO.Al2O3.6H2O + 214 Calories.
4 CaO.Fe2O3.Al2O3 + 5 H2O ——→ 4 CaO.Fe2O3.Al2O3.5H2O + 145 Calories.
3 CaO.SiO2 + H2O ——→ 2 CaO.SiO2 + Ca(OH)2 + 65 Calories.
2 CaO.SiO2 + H2O ——→ CaO.SiO2 + Ca(OH)2 + 27 Calories.
Assume all reactions completed at five years and all silicates in form of CaO.SiO2.
1 Year
2 Years
3 Years
4 Years
5 Years
3 Days
Theoretical Heat Curves of Neat Insulated Cement Grouts Up To Five Years
Assuming No Radiation or Conduction Loss of Heat. W/C = .59
CHART II - Heat Curves of Neat Insulated Cement Grouts While Setting. W/C = .59
H-12
H-13
H-15
EXPLANATION OF CURVES
H-12 — Fine Cement - All Passes 300 Mesh.
H-13 — Normal Portland Cement - 200 Fineness = 90%
H-15 — Coarse Cement - 200 Fineness = 62%
The heat generated in the five year curves was calculated from analyses of grouts at three days and:
3 CaO.Al2O3 + 6 H2O ——→ 3 CaO.Al2O3.6H2O + 214 Calories.
4 CaO.Fe2O3.Al2O3 + 5 H2O ——→ 4 CaO.Fe2O3.Al2O3.5H2O + 145 Calories.
3 CaO.SiO2 + H2O ——→ 2 CaO.SiO2 + Ca(OH)2 + 65 Calories.
2 CaO.SiO2 + H2O ——→ CaO.SiO2 + Ca(OH)2 + 27 Calories.
Assume all reactions completed at five years and all silicates in form of CaO.SiO2.
Theoretical Heat Curves of Neat Insulated Cement Grouts Up To Five Years.
Assuming No Radiation or Conduction Loss of Heat. W/C = .59

coarse cement, was next to H-11 for temperature rise and like H-11 contained much unhydrated cement at the end of three days.

On the lower parts of Charts I and II are shown the probable heat curves of the grouts corrected for radiation and conduction loss and assuming complete hydration of tricalcium aluminate, calcium ferro aluminate, and the hydrolysis of tri and dicalcium silicates to monocalcium silicates. It will be noted that the calculated end temperatures do not differ very markedly from each other in spite of their varied treatment before being used in grouts. (It appears that the actual temperatures reached by the grouts shortly after mixing is more a measure of rate and degree of hydration of the cements than an indication of their potential heat developing capacities in concrete.)

TABLE I. CHEMICAL ANALYSES AND CALCULATED MINERAL COMPOUNDS OF CEMENTS USED IN HEAT TESTS WITH NEAT GROUT

	Laboratory Number						
	H-8	H-9	H-10	H-11	H-12	H-13	H-15
SiO_2	20.84	20.76	20.52	20.14	20.42	20.62	20.24
Al_2O_3	5.48	5.46	5.39	5.23	4.97	5.47	5.08
Fe_2O_3	2.85	2.84	2.81	2.79	2.95	2.97	3.30
CaO	64.62	64.37	63.62	62.00	64.50	64.50	64.80
MgO	1.78	1.77	1.75	1.73	1.78	1.72	1.69
SO_3	1.37	1.36	1.35	1.38	2.62	1.92	1.81
H_2O	1.26	1.64	2.81	5.11	1.61	1.01	.68
CO_2	.57	.60	.57	.49	.79	.61	.18
Insoluble	.57	.57	.55	.58	.18	.20	.30
Total	99.34	99.38	99.37	99.45	99.82	99.02	98.08
Free lime	.66	.61	.70	.95	.50	.67	.35
Free moisture	.14	.55	.92	2.06	.....	.....	.....
Calcium ferro aluminate	8.66	8.62	8.54	8.48	8.97	9.03	10.05
Tricalcium aluminate	9.68	9.66	9.53	9.14	8.18	9.48	7.85
Tricalcium silicate	55.45	55.02	54.07	50.53	57.12	54.54	64.58
Dicalcium silicate	17.71	17.80	17.83	19.48	15.25	17.76	9.08
Calcium sulphate	2.32	2.32	2.31	2.34	4.45	3.26	3.08
Calcium carbonate	1.26	1.36	1.29	1.11	1.79	1.37	.41

TABLE II. PHYSICAL TESTS OF CEMENTS USED IN GROUTS FOR HEAT TESTS

	Laboratory Number						
	H-8	H-9	H-10	H-11	H-12	H-13	H-15
Flour, or particles smaller than 20 microns	46.4	45.6	45.2	47.0	92.0	47.6	31.2
200-mesh fineness	87.4	88.0	89.4	91.9	100.0	90.0	62.8
Normal consistency	21.5	21.0	18.0	16.0	30.0	21.0	20.0
Initial set	2:40	3:15	3:25	3:30	3:45	3:50	5:40
Final set	4:30	5:00	5:10	5:20	5:50	5:50	7:20
Soundness	OK	OK	OK	OK	OK	OK	OK
24-hour neat tension	435	415	350	292	.....	.....	.....
TEST PIECES, 1 PART CEMENT, 3 PARTS SAND							
Strength, pounds per square inch (average of 3 test pieces)							
3 days, tension	314	365	290	202	443	248	130
7 days, tension	352	395	375	278	533	340	185
28 days, tension	450	462	437	322	596	495	250
3 days, compression	2567	2733	2320	1106	6550	240	900
7 days, compression	3476	3500	3083	1666	7566	3173	1333
28 days, compression	3983	4650	3583	2830	10500	4767	1767

TABLE III. MINERAL COMPOSITION OF DRIED CEMENT GROUTS AFTER 3 DAYS HYDRATION

Calculated from chemical analysis, liberated lime, combined water, and assumed degree of hydration

	Laboratory Number						
	H-8	H-9	H-10	H-11	H-12	H-13	H-15
Equivalent free lime	14.75	14.55	12.08	9.00	14.90	14.17	11.83
Combined water	16.03	15.47	15.10	11.37	15.25	13.42	11.06
Unhydrated calcium ferro aluminate	None	.25	1.23	3.87	None	.59	3.10
Unhydrated tricalcium aluminate	None	.28	1.31	4.19	None	.62	2.43
$3CaO \cdot Al_2O_3 \cdot 6H_2O$	11.54	11.20	9.90	6.10	9.85	10.69	6.45
Calcium hydrate	19.48	19.22	15.96	11.89	19.69	18.72	15.63
Tricalcium silicate	1.00	2.00	7.60	22.00	1.80	3.50	19.60
Dicalcium silicate	41.03	41.87	37.20	30.60	40.00	40.10	30.30
Monocalcium silicate	6.07	5.80	5.50	4.50	6.00	5.90	4.50
Calcium sulphate	1.99	1.99	2.00	2.19	3.84	2.86	2.76
Calcium carbonate	1.11	1.18	1.14	1.05	1.55	1.23	.36
Specific gravity of dried grout	2.46	2.48	2.46	2.50	2.43	2.46	2.49
Specific heat of dried grout	.229	.229	.227	.215	.238	.238	.216

TABLE IV. HEAT GENERATED DURING HYDRATION

Calories per gram of cement

	Laboratory Number						
	H-8	H-9	H-10	H-11	H-12	H-13	H-15
Calories, calculated from degree of hydration in neat grouts at 3 days	71.88	69.53	60.45	36.00	69.63	66.47	50.00
Calories for 3-day grouts calculated from corrected temperature rise and specific heat of neat grouts	54.6	54.2	46.9	32.2	56.4	57.0	40.0
Calories calculated to 100% hydration, all silica as $CaSiO_3$	85.8	85.3	84.5	81.9	83.8	85.1	88.9
Temperature rise corrected for radiation loss for 3-day grouts, deg. C.	120	117	99	62	118	116	82
Temperature rise for neat grouts, assuming complete hydration, no radiation loss, and specific heats unchanged from 3-day grouts	143	143	139	141	142	148	146

Table IV shows the amount of heat generated, in calories per gram of dry cement, calculated from the analyses of three-day grouts; then calculated to complete hydration at five years. The third line shows the heat generated at three days, calculated from the temperature rise of the grouts after correcting for radiation loss and the specific heat of the grouts containing free moisture; this specific heat was taken from the specific heat of the grouts dried at 100 deg. C. and the known specific heat of the free moisture present.

Determination of Specific Heat

Much difficulty was encountered in determining the specific heat of the dried powdered concrete grouts. It was found that the powdered samples after being in a thermostat oven 24 hours did not have a uniform temperature, the top of the material being colder than the bottom by several degrees. This was not due to variation in oven temperatures, as tests of different parts of the oven adjacent to the sample with a thermometer proved. Even after several days in the oven this difference persisted but to a lesser degree. It is possible that the cement contains loosely bound water of hydration which slowly breaks away at 100 deg. C.

After heating to 100 deg. C. the dried hydrated grouts were dumped into water in a calorimeter and their specific heats calculated from the rise of temperature. It was found that considerable heat was given off due to wetting of the dried powder, even though the powder was at the same temperature as the water.

At first thought one would think that grinding the concrete grouts had developed new unhydrated surfaces and the hydration of these had caused the temperature rise. But when the concrete was used in the form of lumps almost as much heat was developed as when in the powdered form. A dried grout from which considerable water has been evaporated has a large capillary pore space. Nearly the same quantity of heat was developed by using water free kerosene in place of water, proving that the heat developed when powder and water are mixed is due to surface wetting rather than hydration of new surfaces. Some of the powdered grouts had a surface wetting heat of 10.5 calories per gram.

Another difficulty was that the dried powdered grouts were highly hygroscopic, necessitating extreme caution in preventing them from coming in contact with the air in which case the temperature rose rapidly. In weighing these samples for analytical work some error was introduced by the rapidity with which they took up moisture.

The heat developed, calculated from the analysis of the grouts after three days hydration, is considerably greater than that calculated from the temperature rise and the specific heats of grouts; yet a consideration of the heat developed in mass concrete indicates that the heat calculated from analysis is more nearly right.

Calculated Heat Generated in a Dam

Ivan E. Houk[8] gives the following conditions for the temperature rise in Bull Run dam:

Cement per cu. yd. of concrete....	0.88 bbl.
Minimum rise in temperature....	55.8 deg. F.
Thickness of concrete.....	45.7 ft.
Time required to reach maximum temperature	44 days

One yard of concrete will be made up of the following absolute volumes and weights:

$$\text{Cement} = 0.88\frac{376}{3.1 \times 62.4} = 1.71 \text{ cu. ft. or } 331 \text{ lb.}$$

$$\text{Water} = 0.88\frac{30 \times 8.34}{62.4} = 3.53 \text{ cu. ft. or } 220 \text{ lb.}$$

Water cement paste = 5.24 cu. ft. or 551 lb.
Aggregates = 21.76 cu. ft. or 3530 lb.

If the paste has a specific heat of 0.35 and the rock 0.20 then the average specific heat of the concrete is:

$$\frac{551 \times 0.35 = 193}{\frac{3530 \times 0.20}{4081} = \frac{706}{899}}$$

$$\frac{899}{4081} 0.22 = \text{sp. ht.}$$

The heat developed per pound of cement is:

$$\frac{0.22 \times 4081 \times 55.8}{331} = 151.3 \text{ B.t.u., equivalent}$$

to 84.06 calories per gram of cement used.

That the total heat must be greater than 84 calories per gram of cement is indicated by the following:

At 44 days the cement could not have been fully hydrated; during the 44 days rise to its maximum temperature some heat was lost by conduction and radiation; also some heat was lost by evaporation of free moisture from the concrete surface. So it would not be surprising if the heat developed by hydration and hydrolysis of cement were a little over 100 calories per gram.

A calorimetric test by the writer on the difference of heat of solution in hydrochloric acid of a normal cement and one as thoroughly hydrated as could be obtained gave 105 calories as the heat of hydration.

Although the total heat generating capacity of a cement is not at all altered by change of particle size, or surface area, and slight prehydration within practical limits only affects it to a small degree, there are possibilities of modifying the hygral heat by changes in chemical composition. Because of the limited thermochemical cement data available it is impossible to speak with surety on this point, but it appears that decreasing the quantity of alumina and increasing the quantity of silica to produce more calcium silicates, especially dicalcium silicates, will cut down the total quantity of hygral heat. The increased quantities of dicalcium silicate are not the serious handicap in mass concrete that they are in small size concrete since the higher than ordinary temperatures hasten hydration and strength.

Calcium ferro aluminate does not liberate as much heat as tricalcium aluminate and where it is not practical to limit the alumina at some cement plants, the aluminates can be changed to calcium ferro aluminate by the addition of sufficient iron oxide.

Summary

The total heat generating capacity of cement during hydration is independent of its surface area, or particle size, and is little affected by prehydration within practical limits.

Particle size and prehydration affect the rate of heat liberation and therefore its time temperature relation, many other factors also affecting this relation in concrete. Low tensile and compressive strength up to 28 days in specimens make from coarse ground or prehydrated cements cured at ordinary temperatures is due to slow rate of hydration, but this is no indication of their performance in mass concrete.

Low temperature rises with coarse and prehydrated cements used in neat grouts is due to a lesser degree of hydration. In mass concrete where it is reasonable to expect the end products of hydration to be about the same, similar quantities of heat will be developed per unit of cement used, although the time temperature relation of heat development may vary.

The total amount of hygral heat of a cement can be altered more readily by changing its chemical composition.

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7. Temperatures developed in mass concrete and their effect upon the compressive strength. *Proceedings of the A.S.T.M.,* Vol. 31, 1931, Part 11, Tech. Papers.
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Constancy of Volume of Portland Cement

THE CONSTANCY of volume of portland cement is discussed by A. C. Davis, works managing director of the Associated Portland Cement Manufacturers, Ltd., England, in a recent issue of *Cement and Cement Manufacture.*

Volume changes in sound cements are not noticeable without scientific apparatus. However, unsound cements show undue expansive tendencies so that quite accurate tests for soundness can be made with simple apparatus. Such accelerated soundness tests take the place of long-period tensile tests as to soundness and generally consist in keeping pats of neat cement in steam or boiling water for a period.

The test for soundness in the United States calls for no distortion, cracking or disintegration when the pat is stored in moist air for 24 hours and placed 1 in. above boiling water in an atmosphere of steam at 98 to 100 deg. C. for 5 hours.

The British Standard Specification for Portland Cement specifies the Le Chatelier test for soundness. The apparatus is a split cylinder of thin spring brass 30 mm. in diameter and 30 mm. high with two rods attached to the cylinder, one on each side of the split, and extending 165 mm. (6½ in.) from the center of the mold.

The mold is placed on a small piece of glass and filled with cement paste, keeping the edges of the mold together. It is then covered with another glass plate, a small weight placed on this, and the mold placed in water at 58 to 64 deg. F. for 24 hrs. The distance between the ends of the rods is then measured and the mold put in cold water which is brought to the boiling point in 25 to 30 min. and kept boiling 3 hrs.

After cooling, the distance between the points is again measured. The difference between the two measurements, representing the expansion, must not exceed 10 mm. when first tested but if this is exceeded, the cement may be spread out and aerated for 7 days and retested but must not then exceed 5 mm. expansion. This test, which shows expansion only, has been criticized as not necessarily showing soundness because of the expansion being due to other factors than free lime.

According to the writer, extensive tests conducted by him failed to confirm such criticisms but indicated that the Le Chatelier test had been responsible for a general improvement in cements.

The simplest accelerated test for soundness, according to the author, is to keep the pat in moist air for 24 hrs., then place it in a receptacle of cold water and heat gradually to boiling and boil for 3 hrs. If the pat remains sound, the cement will be satisfactory.

Hydraulic Value of Lime in Cement

IN THE determination of lime in cements in relation to their hydraulic value V. Sevieri contends that all the CaO present in cement is not hydraulically utilizable. Many formulas have been proposed based on the proportions of CaO combined with other constituents, as Al_2O_3, Fe_2O_3, SiO_2, etc., as a measure of the percentage of CaO of value hydraulically. Sevieri proposes the value $\{CaO - [\text{free } CaO + 0.75(Al_2O_3 + Fe_2O_3 + Mn_2O_3 + SO_3)]\}/SiO_2$ (sol.) is equal to or less than 3, as representing the best average value.—*Chemical Abstracts.*

Light Weight Slag Aggregate Now Produced in Chicago

IN SOME AREAS SLAG has been used rather extensively as an aggregate for concrete. The possibilities for its extended use have become extremely bright in recent weeks with the announcement of two new light aggregates, each using slag as a base.

The most recent announcement in this field is by the Chicago Waylite Aggregate Co., which is processing blast furnace slag at its plant in Chicago, Ill. In the August 13 issue of Rock Products a development was announced in St. Louis, Mo., where slag from the furnaces of the St. Louis Gas and Coke Corp. is used.

Comparatively speaking, light weight aggregates are newcomers in the construction industry through many thousands of yards of concrete have been placed where light weight aggregates were employed to obtain recognized economies. This light weight concrete has been used both in poured construction and in precast work. Its use in building units, giving them insulating properties, has resulted in making walls so constructed a most economical type of building construction. This has made available a far greater volume of business, both for cement and aggregates, than was possible without them.

The lighter weight, plus insulation value, makes poured concrete made of such light weight aggregates an important material for fireproofing structural steel, as weight of the protective concrete is reduced and it is believed that the insulating properties of the concrete, together with its fire-resistive properties, will make it possible to reduce the required thickness of concrete for such work. All of which should serve as important factors in winning an important part of such markets for light weight aggregates. And the new materials of slag may be expected to participate in such business.

In the manufacture of "Waylite" the slag passes directly from the furnace in a molten state to a large revolving cylinder.

Here steam is introduced, coming directly in contact with the slag at high temperature. No explanation has been offered for the expansion which results, but the appearance is very much like pumice stone. Millions of tiny air cells are created, having a generally uniform size throughout the material.

Pieces of material are formed as a result of this intermingling of the hot slag and steam ranging in size from fine sand to chunks as large as 12 in. through. An indication of the thoroughness of this expansion is gained by knowing that the sand which is produced has a weight of 40 to 50 lb. per cu. ft., depending on the coarseness of the separation.

Gradations that may be combined to meet any requirements

Little time is required in the expansion chamber, the change being almost instantaneous. When the material has been discharged it is allowed to cool and is then crushed and screened to size.

Many experiments have been made with the material and it has been found to have very diversified uses, though it was primarily developed as an aggregate for concrete products and it is believed that the largest volume of business will come from that field.

It has been graded in many sizes and it is possible to get combinations of sizes to meet the requirements for any type of product, the manufacturer states. One interesting result has been obtained from the product passing a 200 mesh screen. This material is said to have been tested for properties as a masonry cement and to have given tensile strengths equal to standard portland cement. It is therefore believed that this property will prove of value to concrete products, the aggregate thus adding to the strength that would be obtained with normal mixes and aggregates.

As will be noted from the illustrations of the aggregate, it has broken surfaces which provide an exceptionally good bond. The surface of the material as it comes from the mixing chamber shows a rather glassy, fused coating, but it has no appreciable thickness and, when the aggregate has been crushed and graded, forms a very small proportion of the exposed surface.

Physical Properties of the Material

Tests of concrete using Waylite as aggregate have been made by the Pittsburgh Testing Laboratory and are reported as follows:

A 1:1½:2½ mix using both Waylite fine and coarse aggregate, dry, loose volume was used with a water-cement ratio of 0.96. The fresh concrete thus obtained weighed 101.3 lb. per cu. ft. The gradation of the aggregates was according to the table at the top of the column following.

GRADATION OF AGGREGATES

Sieve number	% retained on sieve Fine	Coarse
100	84	....
50	76	....
30	64	....
16	46	99
8	11	96
4	....	72
⅜ in.	....	22
½ in.	....	6
Fineness modulus	2.81	5.89

The compressive strengths obtained from tests of this concrete were:

AT 7 DAYS

	Total load	Lb. per sq. in.
Specimen No. 1	74,000	2707
Specimen No. 3	70,000	2560
Specimen No. 5	72,500	2652
Average	72,166	2640

AT 28 DAYS

	Total load	Lb. per sq. in.
Specimen No. 2	89,030	3257
Specimen No. 4	86,340	3158
Specimen No. 6	90,750	3319
Average	88,710	3245

The properties claimed for the material, in addition to light weight, are that it is fireproof, has good insulating properties, it has acoustical properties, low water absorption, that it makes a nailable and easily sawed concrete, that it will not stain or set up chemical action and that it is easily workable. Its color varies from white to light buff.

The plant is located in the Chicago district, convenient both for rail and truck shipment. The present capacity of the plant is 100 cu. yd. per day and a capacity of 400 cu. yd. per day is expected to be reached within 30 days. At the present location a total capacity of 700 cu. yd. is eventually expected to be reached.

Harvey C. Adams is president of the company and has been active throughout its development. Mr. Adams is assisted by J. A. Quillinan.

Hints and Helps for Superintendents

Rinsing and Sizing Screen

By Ernest Moyer
Alturas, Calif.

WE HAVE HAD TROUBLE with the cast-iron spiders on an old shaft of our rinsing and sizing screen which could not be kept keyed tight, also with the spider arms which could not be kept bolted tight.

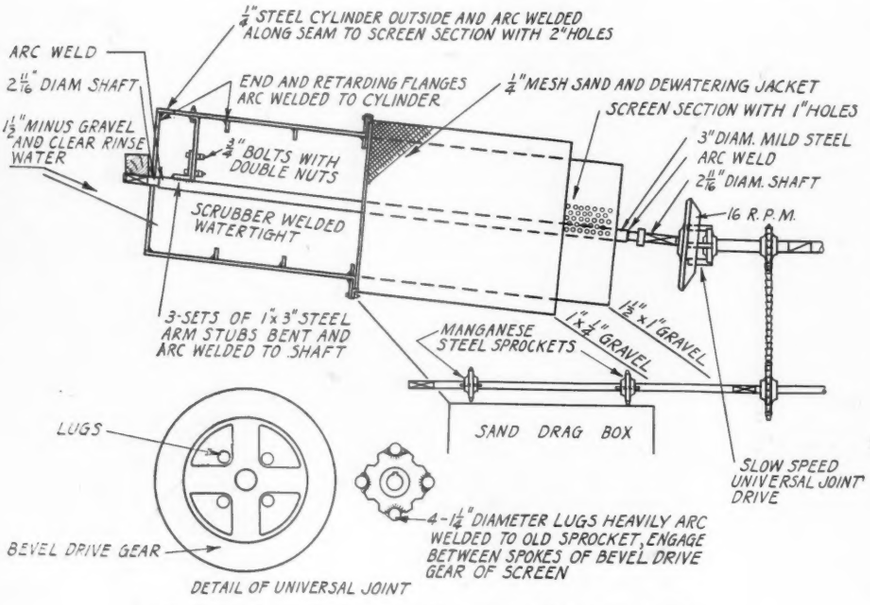
Close-up of universal drive

The accompanying illustrations show how we rebuilt the screen. The result has been that we have completely eliminated those troubles which we were having.

Having no machine shop, we cut off the ends of the 2 11/16 in. shaft and welded them to the present center section of 3 in. round steel. By revolving the shaft in V wood blocks, heating at the welds with a torch, and striking a few blows where necessary the ends were trued up to run in the bearings. Arm stubs were then bent and welded to the shaft, to which the screen was bolted. The bolts used for this were ¾ in. with double nuts drawn to the limit of the bolt strength by a special wrench device which we made. The screens have been in operation now for several months and the bolts still remain perfectly secure.

A slow speed universal drive which we made for the screen, which is chain driven, has also proved quite satisfactory. This consists of four lugs which were welded to a sprocket. These heavy lugs engage openings in the screen bevel gear, and eliminate springing of the shafts which might occur.

On the scrubbing section we welded a water-tight cylinder over the old 2-in. screen section and find that the added effect of the old screen has been very beneficial in improving the efficiency of the washing section.

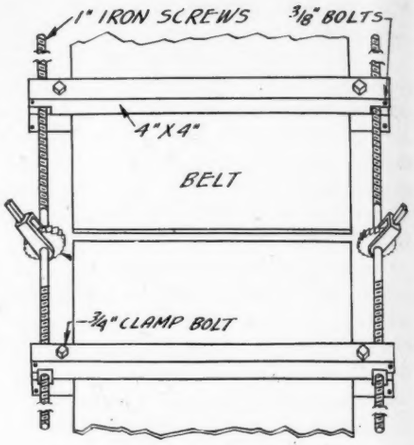

¼" STEEL CYLINDER OUTSIDE AND ARC WELDED ALONG SEAM TO SCREEN SECTION WITH 2" HOLES
ARC WELD
2 11/16" DIAM SHAFT
1½" MINUS GRAVEL AND CLEAR RINSE WATER
END AND RETARDING FLANGES ARC WELDED TO CYLINDER
¼" MESH SAND AND DEWATERING JACKET
SCREEN SECTION WITH 1" HOLES
¾" BOLTS WITH DOUBLE NUTS
3" DIAM. MILD STEEL ARC WELD
2 11/16" DIAM. SHAFT
16 R.P.M.
SCRUBBER WELDED WATERTIGHT
3-SETS OF 1"x3" STEEL ARM STUBS BENT AND ARC WELDED TO SHAFT
MANGANESE STEEL SPROCKETS
1"x1" GRAVEL
1½"x1" GRAVEL
SAND DRAG BOX
LUGS
SLOW SPEED UNIVERSAL JOINT DRIVE
4-1¼" DIAMETER LUGS HEAVILY ARC WELDED TO OLD SPROCKET, ENGAGE BETWEEN SPOKES OF BEVEL DRIVE GEAR OF SCREEN
BEVEL DRIVE GEAR
DETAIL OF UNIVERSAL JOINT

Details of screen construction and driving mechanism

Belt Clamps Equipped with Ratchets

By Dare Paris
Monrovia, Calif.

CUTTING and taking up large elevator and conveyor belts requires lots of time, either with belt clamps or chain blocks. The accompanying illustration shows a belt clamp equipped with a ratchet which speeds up the work 50%. The iron screws have machine square cut threads with rapid pitch. A 6-in. ratchet wheel is used equipped with a 12-in. handle. In backing off a small bolt is placed behind the handle through a hole in the ratchet wheel which is drilled there for that purpose. One of these clamps will frequently pay for itself after one or two belts have been spliced.



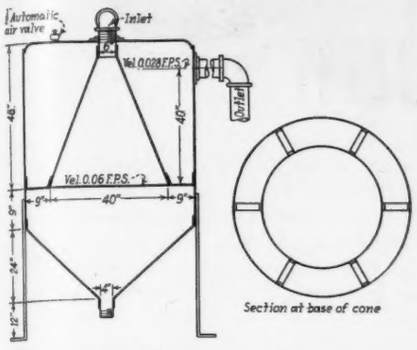
Ratchet wheels speed operation

Sand Trap Makes a Good Classifier

THE ACCOMPANYING illustration is from an article in *Railway Engineering and Maintenance* which describes a sand trap, evidently worked out from a knowledge of settling apparatus.

The device was made from an old boiler shell. The main cylinder is 57 in. high. At the bottom is a cone with about a 50 deg. slope. The peculiar part of the device is the inlet. This is a cone extending well down into the cylinder. The water and sand falls through this cone and the water rises between the cone and the cylinder to an overflow pipe. Handling 15,000 gal. per hour, the rising velocity at the overflow is 0.028 ft. per sec., which would theoretically split on about 80 mesh.

The purpose of the trap was to remove sand before sending the water to a water softener. The sand was fairly fine, but a sieve analysis shows that it saved about the sizes one would expect it to from the dimensions and flow. To make a practical device



Classifier from old boiler shell

of this for sand plant use it would be necessary to add some sort of automatic discharge for the sand and to change the dimensions to fit the capacity of the pumps used in sand plant practice.

The article says that the net area of the cylinder must equal or exceed twice the area of the base of the inlet cone and that the base of the cone must be level for satisfactory work. The apparatus works under a pressure stated to be from 24 to 32 lb. An automatic air valve in the top prevents the accumulation of air at the top of the cylinder.

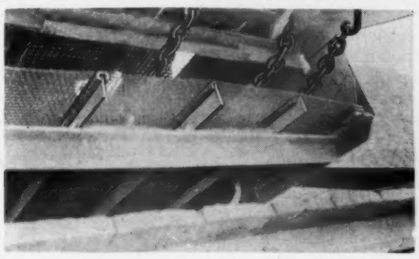
Debris Storage

AT THE sand and gravel plant of the Coon River Cooperative Sand and Gravel Association, Des Moines, Ia., the oversize from one of the screening operations contains mostly foreign matter mixed with the oversize gravel, clay balls, old roots, etc. Instead of allowing this debris to accumulate around the plant, presenting an unsightly appearance, a deep pit has been constructed lined with concrete stave blocks similar to those used for erecting farm silos.

When this "depressed silo" is full, the clam-shell crane loads the material to trucks to be permanently disposed of.

How to Get Better Service with Vibrating Screens

IF A RUBBER HOSE is split open and the hose placed over the metal supports underneath the wire of a vibrating screen the screen will last much longer, the hose taking up the impact. The illustration shows the split pieces of hose in place on a screen where this has been successfully tried.



Hose protects screen

At the same plant the material is such that it continually tends to clog the screen. A number of heavy chains were suspended near the upper end of the screen and allowed to rest on its surface. They keep the screen clean and free from clogging.

The accompanying illustration shows three of these chains in position.

Classifying Sand

A METHOD of classifying sand not often found in use is employed at the Welch-Sandler sand plant at Frisbie, Kan. A hinged steel plate is placed in the bottom of the launder leading to the Autovortex sand cones. By raising or lowering the door the relative amount of course material going to the concrete sand cone is regulated. The material which flows over the hinged door passes to a cone that produces the fine or mason's sand.

Hinged plate in classifier launder

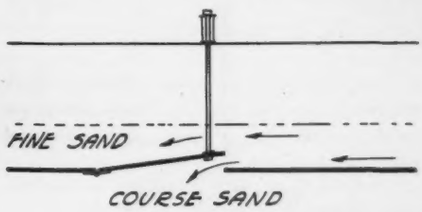


Plate is adjustable

Storing Rubber Belts

DURING THE PRESENT PERIOD many industrial plants are shut down either wholly or in part, and date of reopening is indefinite. It is essential that rubber belting be protected from deterioration during the shut-down period if economical operating costs are to be enjoyed when plants are re-opened.

After an exhaustive study on the storage of rubber products, the B. F. Goodrich Co., Akron, Ohio, says in a recent bulletin:

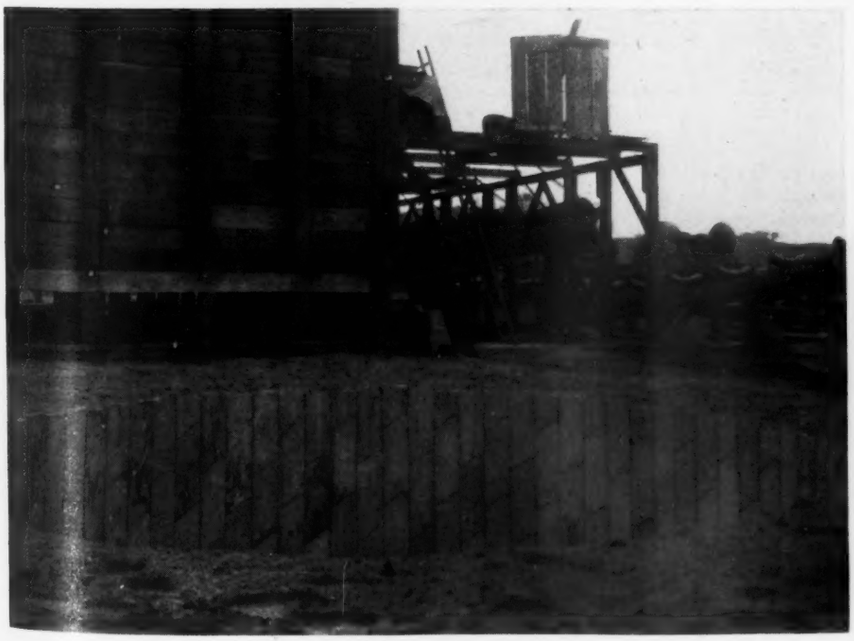
"Belts should be stored in a dark, cool (not over 70 deg. F.) place which is maintained under humidity conditions which are not too dry. This does not mean belts should be stored with one end standing wet, but the air of the warehouse should not be too dry. Direct sunlight and warm air should be avoided wherever possible.

"To further protect belting in storage the following preparation may be used to treat the edges and exposed face of belts in roll form:

One quart shellac
One pint alcohol.
One and one-half quarts household ammonia
Three quarts water.

"This solution can be quickly applied with a whitewash brush. One gallon should cover about 300 sq. ft. It can be purchased already mixed, combined with special age-resisting chemicals.

When the belts are not taken off it is suggested that the installation be checked to make sure the tension has been removed."



Uses "depressed" silo as temporary storage for oversize material

Rock Products Clinic

Lime as an Explosive

THE EDITOR: We have noted an inquiry by "Chief Engineer," together with the Editor's Note with reference to data on lime as an explosive in ROCK PRODUCTS Clinic, September 10 issue.

In Volume 33 (for 1883-84) of the *Transactions of the North of England Institute of Mining and Mechanical Engineers,* pages 13-18, in an article by Frank Murray Still, entitled "On Mining Coal by Compressed Lime," the following information is available:

From this article we learn that this method of mining was patented to Messrs. Sebastian Smith and Moore of Shipleigh Collieries, near Derby.

From the description it appears that a very pure limestone is burned and after having been carefully calcined is ground to a fine powder. By means of a hydraulic press this powder is compressed in a die, 2½ in. in diameter and 7 in. deep, under a pressure of 40 tons "applied at both ends of the column," whereby the length is reduced from 7 in. to 4½ in. In molding the cartridges a groove is formed along the side of each. In charging the bore hole an iron tube ½ in. in diameter, open at one end and closed by a valve at the other, is inserted the full length of the bore hole on one side. This ½-in. tube is also perforated with small holes at intervals along its length and covered with calico to prevent dust from getting into the apertures in the tube.

The lime cartridges are then carefully tamped into the bore hole in such manner that the ½-in. iron tube fits into the groove on the sides of the cartridges. When a charge has been carefully tamped in, it is then covered with stemming and tamped as with a charge of powder. Then a vessel containing a volume of water equal to the volume of the cartridges is attached to the end of the tube projecting from the bore hole. The valve is opened and this water is forced, under pressure, into the bore hole. When the entire volume has been inserted, the reaction of the caustic lime with the water slowly begins and increases with acceleration.

Through the pressure of the steam generated and the increase in the volume of the lime, due to slaking, the coal is broken down. The increase in volume due to slaking is about five times that of the original volume of the cartridge.

Also we are enclosing copy of a couple of paragraphs taken from "The Colliery Manager's Handbook," by Caleb Pamely.

We hope this information will be of some service to the "Chief Engineer" and also to yourself, since you are seeking information through your Editor's Note.

If this is not sufficient to meet the "Chief Engineer's" needs we shall be glad to go a little further in giving him assistance.

NORMAN G. HOUGH,
President and General Manager,
National Lime Association.

The paragraphs referred to are quoted:

The use of *Lime Cartridges* as a substitute for blasting has been tried within the last few years. The system is patented by Messrs. Sebastian Smith and Moore. Nearly pure carbonate of lime is used in the preparation of these cartridges. Being ground to a fine powder, it is by means of a specially arranged hydraulic press subjected to a pressure of 40 tons simultaneously at both ends, by which means its density is nearly doubled. In their preparation a groove is formed on the side of the cartridges about ½ in. in diameter. In the shot hole an iron tube, ½ in. in diameter and having a small groove on the upper side and provided with perforations, is inserted along the whole length of the bore hole. This tube is enclosed in a bag of calico, which covers the perforations and one end, and has a tap fitted on the other. The cartridges are then inserted and lightly rammed so as to insure their filling the bore hole. Tamping is then used as with gunpowder, and a small force pump being connected with the tap at the end of the tube by means of a short flexible pipe, water, equal in bulk to the quantity of lime used, is forced in. The water is driven to the far end of the shot hole through the tube, escaping as it passes along at the groove and through the perforations and the calico flowing towards the tamping into the lime, there saturating the whole of the charge and driving out the air before it. The tap is then closed, so as to prevent the escape of the steam generated by the action of the water on the lime, and the flexible pipe removed. The action of the steam first takes place, cracking the coal away from the roof, and this is followed by the expansive force of the lime.

In a seam of coal, having a good, smooth parting, this means of bringing down the coal after it is holed operates fairly well. If the coal be very strong it is not so successful, neither is it so where the coal is very open or porous, for the steam escapes through the pores and a great part of the force is thus lost. Probably for these reasons its use has not become at all general.

The editor has also received a communication from a midwest lime manufacturer stating that he has furnished lime for an explosive for use in quarrying tripoli in this country. The editor is now attempting to get some specific information from the tripoli miners as to results, etc.

THE EDITOR: Re your inquiry as to use of lime in blasting operations, the enclosed is quoted from an unpublished manuscript which I prepared some 12 years ago for the National Lime Association.

I recall that at the time it was written it was based on an actual occurrence where someone used the idea in breaking out an old brick column in the center of a machine shop during alterations that were made without interrupting the operation of machines. I believe a temporary wooden box was built around the pier before the "blasting" took place, so that as it crumbled the debris fell inside the box and was subsequently removed through a door left for the purpose.

Unfortunately, I cannot vouch for the accuracy of the foregoing, as it is rather a hazy memory, and I cannot recall the specific facts that were available at the time. If it is of any help, however, here it is, with my compliments. SIDNEY P. ARMSBY,

Technical Consultant on Lime.

Houston, Tex.,
September 13.

The quotation is as follows:

Wrecking Operations. To break up an old stone wall or other piece of masonry, or to knock out a superfluous brick pier without the use of dynamite, no slow hand labor is required. Simply drill a good-sized hole in the wall, making this bottle-shaped with as small an opening as possible. Put in quicklime till this hole is almost full, and make a tight-fitting wooden plug that can be driven firmly into the opening. Quickly pour in enough water to slake the lime, and drive home the plug.

The expansion of the lime as it slakes will exert a tremendous pressure that will easily break up any ordinary piece of masonry.

THE EDITOR: I note on page 46 of the September 10 issue of ROCK PRODUCTS that you are interested in any use of lime as an "explosive."

One of the very old subrosa industries of the Missouri Ozarks is known as "jugging" fish. This operation consists in placing a pound or two of quicklime in a gallon stoneware jug; to this is added a quart or more of water. The stopper is then driven home and the jug quickly thrown into the stream or lake. In a short time the steam generated by the slaking action explodes the jug with violence. The shock stuns all the fish in the immediate neighborhood and they repose gently upon the surface of the water, from which they are gathered by the so-called fishermen.

This method of catching fish is, of course, illegal, and within recent years several men have been sentenced to the penitentiary for dynamiting fish, which is the modern substitute for the lime in the jug.

H. E. WIEDEMANN,
Consulting and Analytical Chemist.

St. Louis, Mo.,
September 13, 1932.

What Constitutes "Good" Screening Practice?

THE EDITOR: I would like to get your idea or the idea of the trade on what constitutes good screening practice. I presume that this should be based upon the per cent retained, using a test screen of the same size as the plant screen upon which the material is made. For example, if we are making a material which is screened on a 1½-in. screen, and it shows 30% passing a 1¼-in. test screen, then we would call this screening efficiency 70%.

In checking up a lot of our results, we ran across the phenomenon that the smaller sizes seem to be doing better work than the larger sizes. I give you certain materials as follows:

	Upper size	Lower size	% passing lower size
¼-in. crushed stone....	⅝-in.	¼-in.	8%
½-in. crushed stone....	1⅛-in.	⅝-in.	30%
¾-in. crushed stone....	1⅜-in.	1-in.	40%
1½-in. crushed stone....	2½-in.	1⅜-in.	32%
(Note: A very long particular case.)	1⅜-in. screen in this		
Ballast	4-in.	2½-in.	37%
Gravel tailings	.....	1¼-in.	30%

Of course, I realize that the area of the screening surface with respect to the tonnage has an important bearing, but in general, in all our plants, I notice this distinct trend of greater precision in the smaller sizes than in the larger sizes.

Therefore, in the parlance of screening, could we set down a scale of precision somewhat as follows:

60% efficient = Poor
70% efficient = Fair
80% efficient = Good
85% efficient = Very good
90% efficient = Excellent

Your thoughts in this connection will be greatly appreciated.

"EASTERN OPERATOR."

Editor Shaw's Reply

Replying to your letter, I know of no established method of evaluating screens and screen efficiency applicable to all cases. The method you speak of, finding the percentage of undersize in the screen oversize, is much used and is as good as any for judging one day's work with another, and also to show how closely the product comes to specification requirements.

However, it does not really measure screen efficiency. If there were no oversize in the feed there could be none in the product and the screen would be rated as 100% efficient although it was doing nothing. On the other hand, if there was a very large percentage of undersize in the feed, the screen might remove 90% and still leave enough to have the oversize of the screen, say, 50% undersize, which would look like very poor work, even though the screen was doing very well indeed.

A formula which takes into account the undersize in the feed as well as that in the products is written:

$$E \text{ (efficiency)} = \frac{100\,(f - o)}{f\,(100 - o)}$$

f being per cent. undersize in feed and o, in oversize product. This you will recognize as the ordinary "recovery" formula used in problems of concentration, classification and so on. In a word it assumes that the function of the screen is to recover the oversize and judges its work by the percentage of recovery. Assuming that there was 30% of undersize in the feed (f) and that 10% was left in the oversize (o) then the recovery would be:

$$\frac{100\,(30 - 10)}{30\,(100 - 10)} = 0.74$$

and the recovery of 0.74 of the undersize would be taken as 74% efficiency.

This, in my view, would be no better than average work with coarse screens. If the undersize in the oversize were only 5% the efficiency would be about 88%, which I should say would be good enough. I have run through a number of screening records given in hand books and textbooks and find efficiencies figured in this way running from 42 to 99.7%, all taken from actual plant practice.

But (and this is a point to be especially noted) regardless of these efficiency figures, no one can say that the screen with 42% efficiency was not doing as good or better work than the screen with 99.7% efficiency. It depends on the feeds handled, and the screen with 42% efficiency might have had a feed largely of what are called "difficult grains." These are grains which are very close to the size of the screen opening by which they are to be separated. To take an extreme case, a feed of 1-in. and ¼-in. grains with no intermediate sizes would have no difficult grains and would be very easy to separate over a ¾-in. mesh screen, say. But if the feed had a lot of grains that would just pass a ¼-in. hole and we tried to separate them with a screen with ¼-in. holes we would find that we would get a very low efficiency indeed. It would be necessary to use 5/16-in. or even ⅜-in. holes to get a good separation of the ¼-in. grains, and this is the general practice. Most specifications permit 5 to 10% of oversize so that such screens can be used.

In passing, I have read of efficiency formulas that take into account these difficult grains, but it does not seem necessary to use them in our industry as their effect may be obviated by using larger screen openings.

Another reason why it is hard to compare screen efficiencies is that which you mention, namely, they depend on the rate of feeding, or on the tons fed per hour per square foot of available screen opening, to put it exactly. If the rate of feeding is increased beyond a certain critical point, the efficiency drops off sharply because the crowded condition keeps even the finest grains from getting down through the mass to the screen openings. The critical point is, of course, that rate of feeding which will allow a product to be made that will just pass specifications. A lesser rate would make a better product but would cut down the tonnage and a greater rate would increase the tonnage but make a poorer product.

I have found this last condition with most if not all of the fine screens I have had to run. We always had to crowd them to get the tonnage through and put up with a poor product and a low screen efficiency. So I did not find as you say that you do, that fine screens were more efficient. Theoretically fine and coarse screens should be equally efficient, provided both were fed at a proper rate and the feed of one did not have more difficult grains than the feed of the other. This will hold true until one gets down to the very fine screens with which screening is difficult for other reasons than the quantity and kind of feed.

The shape of the hole and its relation to the average shape of the grain is another thing that affects screen efficiency. A long slot will usually screen more than a round hole of the same diameter as the width of the slot but not always. I had a case not so long ago where I recommended the use of a ⅝-in. round hole instead of a long slot, ½-in. wide. The feed had a lot of flat pieces that blinded the slots badly, and enough of the large flat pieces passed so that the undersize had too much oversize. The ⅝-in. round hole gave much more ½-in. product and it had only a little oversize.

To sum up, I think the best way to figure screen efficiency is to use the formula given in this letter. It is standard enough to be given by Richards, Taggert and other writers of textbooks. However, it should always be remembered that it does not tell the whole story and the quality of the feed has to be taken into account.

EDMUND SHAW.

One Way of Keeping Men Employed

THE EDITOR: During the winter of 1930-31 our crushed stone business slumped off, as did that of most other producers. We could only run a limited number of days with the orders we had, due to the fact that our steam shovels, etc., could complete small orders in a very short period of time. This meant that we had to carry a number of our employes over last winter, or turn them loose, which we did not consider a fair thing to do.

Last fall we purchased three No. 7½ Allis-Chalmers crushers and installed them, and up to this time have been able to keep our men employed by setting aside steam shovels and using these crushers, letting the men do the work of the steam shovels. Of course we would not consider making this a permanent proposition, as we could not afford it, but as a temporary expedient to meet the depression conditions it has worked out splendidly.

WM. E. CARSON, President,
Riverton Lime Co., Riverton, Va.

Editorial Comment

A United Mineral Aggregates Industry?

Frankly, these comments are inspired by some amusing and extravagant claims made by the editor of a contemporary publication in this field to the effect that the coming joint meetings and exhibit of the National Sand and Gravel Association and the National Crushed Stone Association in Detroit next January are the fruit of "his editorial campaign" started in February, 1931! He also claims that ROCK PRODUCTS has been "conspicuously and fearfully silent on the subject." There is a good natured laugh in those two pretensions for us, and we are sure for the great majority of the industry which has been reading ROCK PRODUCTS these dozen or fifteen years; for our contemporary is doubtless sincere in his belief, but not very familiar with facts and sentiment in the industry. However, it served a useful purpose, so far as we are concerned, for it developed a desire to refresh our memory on the history of the organizations in this field, which was interesting, and we believe will prove interesting and instructive to you.

The first job the present editor of ROCK PRODUCTS had, when he joined the staff of the paper late in 1917, was to sound out both crushed stone and gravel producers on the desirability and feasibility of getting together in *one* group to meet acute conditions in the construction industry that had developed as a result of the war. That *first* editorial effort was an argument for a national mineral aggregates association! At that time an intimate knowledge of the industries from personal contacts with representative producers was somewhat lacking. Nevertheless, we got much encouragement and ROCK PRODUCTS took an active part in the organization of the Mineral Aggregates War Service Committee, which grew out of simultaneous but separate meetings of stone, gravel and slag producers on August 13, 1918, in Washington, D. C.

The necessity for national organization of producers was far greater than the necessity for *one* organization, and it was early apparent that it would be much easier to establish separate national associations in the three groups than to bring them together into one. The sand and gravel industry already had a national association, founded, incidentally, but a short time before by E. H. Deffebaugh, former publisher and editor of ROCK PRODUCTS. It remained to organize the crushed stone producers, and this was done through invitations to attend a meeting in Chicago, early in February, 1918, sent out by ROCK PRODUCTS. The editor of this journal, incidentally, was the first secretary of the National Crushed Stone Association. At the same time he bent every effort to assist in reviving the National Sand and Gravel Association. As every producer knows, this journal has been a steadfast booster and impartial friend of both associations since their inceptions, and would now, as in 1918, far rather see them continue to operate independently than hazard the possibility of lessening the good they are accomplishing through any attempt to force an amalgamation prematurely.

There was a number of producers at that time who favored one national organization for both, and ROCK PRODUCTS actively promoted the idea, but developments proved that the great majority did not; competition between the two industries was as keen as it is now, and while both groups of producers recognized the need of organization to meet common hardships brought about by the war and restrictions on construction, they believed that their common problems could best be handled by a joint committee, while the industries themselves maintained their separate national organizations. The situation in other respects was similar to that of today: There was forming a Highways Industries Association which sought to consolidate these three mineral aggregate associations, as well as many other interests, into one large "powerful" group.

Of special current interest, in view of the coming conventions in Detroit, is a three-page editorial in ROCK PRODUCTS, October 9, 1918, which bears the caption: "Shall There Be a Joint Convention of the Stone and Gravel Industries?" in which such prominent producers of both materials as J. R. Sensibar, Construction Materials Co., Chicago; John Wunder, Trap Rock Co., Minneapolis, Minn.; Guy C. Baker, Greenville Gravel Co. (now the American Aggregates Corp.), Greenville, Ohio; John Prince, Stewart Sand Co., Kansas City, Mo.; T. E. McGrath, McGrath Sand and Gravel Co., Lincoln, Ill.; Allen Patterson, Bluffton-Lewiston Stone Co., Lima, Ohio; W. L. Sporborg, Rock-Cut Stone Co., Syracuse, N. Y., and others expressed favorable opinions of ROCK PRODUCTS' suggestion for separate meetings of the two organizations at the same hotel at the same time—exactly what is to happen in Detroit next January.

The Highways Industries Association died early and the Mineral Aggregates War Service Committee ceased to function with the end of the war, but the three national associations—stone, gravel and slag—took a vigorous hold on life and have grown in membership and power ever since. The time was not ripe for a consolidation, although to our mind, and to the minds of some of our sympathetic friends, *that* was the time to have gotten the industry together. However, none of us abandoned hope; it was realized that it would be a matter of evolution.

Hardly had the Mineral Aggregates War Service Committee ceased to function than the industry was confronted by a crisis created by the proposal of the railways to make a stiff advance in freight rates on all these commodities, early in 1919. This led to the *first and only joint* session the three mineral aggregate industries have ever held—when 400 sand, gravel, crushed stone and slag producers met in Chicago, January 24, 1919, to battle with an assembly of railway freight representatives. The success of the

meeting in heading off the contemplated increases led ROCK PRODUCTS to comment again on the advisability of one national organization. An editorial in our February 26, 1919, issue, reads: "The one big lesson learned in all this freight rate controversy is merely the old, old adage of the efficacy of a united front. Only the existence of the National Associations made this victory possible. . . . Also, one big step has been taken in bringing the two National (or rather, including slag, the three National) Associations closer together." However, they fell apart again, when the crisis was passed. But some of us continued to hope.

The associations continued their separate ways until the annual conventions of 1924 at St. Louis, Mo.—the first at which the National Crushed Stone Association held an exhibit of machinery and equipment. With the assistance of John Prince, ever a believer in *one* National Association, it was possible to bring about the simultaneous conventions of both associations at the same time in the same city, but at different hotels. However, it was arranged that an invitation was extended the sand and gravel producers to visit the crushed-stone exhibit, which they did, almost if not entirely unanimously. Incidentally, Mr. Prince and the editor of ROCK PRODUCTS were criticized at the time by some members of both associations for this coincidence of conventions, and pains were taken for some time thereafter to prevent repetition, although no casualties resulted—and we believe a lot of good will that was afterward to bear fruit did result.

The next development was the formation of the Wisconsin Mineral Aggregates Association, which was hailed by all friends of the "consolidation" movement as pointing the way to the eventual union of the two national associations by first getting together the producers of the various materials in local associations. Unfortunately, the Wisconsin organization eventually broke up, as did several similar ones in other states. Right now the Wisconsin aggregate producers are reorganizing in a similar group, which we all hope will prove more successful.

In the interim between the first manufacturers' exhibit at the St. Louis convention of the National Crushed Stone Association in 1924 and the present time, the Manufacturers' Division of the National Sand and Gravel Association was organized and annual exhibits established. Naturally, these exhibits became increasingly important parts of the annual conventions of the two industries and there came to be considerable overlapping of membership in the two manufacturers' divisions. The custom had grown up since the St. Louis conventions of holding the two conventions about as far apart as possible, sometimes the same week, sometimes in succeeding weeks—a custom which made it quite inconvenient for those who desired to attend or exhibit at both.

Fortunately the headquarters staffs of the two associations soon established a friendly and understanding relationship and through their good offices the conventions came to be set for the same city and the same hotel, but in successive weeks, very much to the convenience of the exhibitor associate members as well as of producers who are members of both associations—and this interlocking of membership has grown slowly, but surely. It reached the point in 1931 that one producer, John Prince, past-president of the National Sand and Gravel Association, became a member also of the board of directors of the National Crushed Stone Association.

In another way the three aggregate associations have been drawn closer together in the last few years, in which research work on aggregates has been one of the principal activities of all three. This was the formation of a joint technical committee on research, consisting of the three research engineers, which has served in some degree at least to coordinate the research and to maintain friendly and helpful contacts.

We have reviewed this recent history of the industry that the reader may have the whole picture before him as he plans his attendance at the Detroit meeting next January. That the matter of the advisability of a consolidation of the associations will be an active issue is obviously inevitable, since it has been an issue always since the war days of 1918. ROCK PRODUCTS still believes it would be a good thing and by no means impossible of accomplishment in such a way as to be satisfactory to all three groups. The issue is much more important now than it has been in recent years because of the need for economy and the prevention of useless waste. And where some producers of all three materials are called upon, as is the case, to support three independent national organizations in the industry, with three independent research laboratories, all ostensibly working for the same purpose—to find out the truth about aggregates—it is obvious there are waste and lack of coordination, at least so far as these producers are concerned.

On the other hand, each year since the editor of ROCK PRODUCTS wrote his initial editorial in favor of such a consolidation, he has become more intimately acquainted with all the factors that have operated to prevent such a consolidation, and he knows that some of these reasons, or arguments, are sound and will be hard to overcome. Nevertheless, a real emergency exists. The danger to the entire highway construction market far transcends in importance any arguments as to the relative merits of the various materials for special purposes in particular localities. If the industries do not jointly *fight for* their common market, as they fought together in Chicago in 1919 against ruinous freight rates, there is very likely to be no immediate future market for them to *fight over*.

So be prepared, when you go to the Detroit conventions next January, with a well thought-out opinion of the advisability of joint action, and how it can best be expressed. It may not find a place on the programs but it is sure to be a matter for serious consideration notwithstanding. Also, those of you who are new to the proposition, do not be misled into thinking for one moment that these simultaneous meetings, the joint exhibit, and the issues that will arise were born of any one man's brain or editorial suggestions or agitation. They are the natural evolution from all that has gone before and the fruit of the brains of more practical, purposeful and interested men than editors of the business publications in this industry.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	*Dividend
Allentown P. C. 1st 6's[47]	9-21-32	95	100	
Alpha P. C. com.[2]	9-19-32	9	10	25c qu. Apr. 25
Alpha P. C. pfd.[2]	9-19-32	.....	85	1.75 qu. Sept. 15
Amalgamated Phos. 6's, '36[19]	9-16-32	88½	92	
American Aggregates com.[19]	9-16-32	1	4	
American Aggregates pfd.[19]	9-16-32	5	10	1.75 qu. Jan. 1
Amer. Aggr. 6's, w.w.[19]	9-16-32	35	40	
Amer. Aggr. 6's, ex.w.[19]	9-16-32	33	38	
Amer. L. & S. 1st 7's[27]	9-20-32	50	.....	
Arundel Corp. com.	9-19-32	21 actual sale		75c qu. Oct. 1
Bessemer L. & C. Class A[4]	9-16-32	.....	4	
Bessemer L. & C. 1st 6½'s[4]	9-16-32	18½	.....	
Bloomington Limestone 6's[27]	9-20-32	No market		
Boston S. & G. new com.[37]	9-16-32	3	5	5c qu. July 1
Boston S. & G. new 7% pfd.[37]	9-16-32	18	25	87½c qu. July 1
Boston S. & G. 7's, 1934[19]	9-16-32	55	60	
California Art Tile, A	9-16-32	1½	4¼	
California Art Tile, B[9]	9-15-32	.....	4	
Calaveras Cement com.	9-16-32	.....	2¼	
Calaveras Cement 7% pfd.	9-16-32	.....	50	1.75 qu. Oct. 15
Canada Cement com.	9-19-32	4¼	4⅞	
Canada Cement pfd.	9-19-32	30	33	1.62½ qu. June 30
Canada Cement 5½'s[42]	9-15-32	81	84	
Canada Crushed Stone bonds[43]	9-15-32	60	65	
Canada Crushed Stone com.[42]	9-15-32	1	.....	
Certainteed Products com.	9-19-32	2½	2¾	
Certainteed Products pfd.	9-19-32	10	10½	1.75 qu. Jan. 1
Certainteed Products 5½'s	9-19-32	42¾ actual sale		
Cleveland Quarries	9-19-32	.....	30	10c qu. Sept. 1
Consol. Cement 1st 6½'s, A[44]	9-20-32	No market		
Consol. Cement pfd.[27]	9-20-32	No market		
Consolidated Oka Sand and Gravel (Canada) 6½'s[12]	9-16-32	40	50	
Consolidated Oka Sand and Gravel (Canada) pfd.[42]	9-15-32	.....	50	
Consol. Rock Prod. com.[35]	9-15-32	5c	15c	
Consol. Rock Prod. pfd.[35]	9-15-32	40c	60c	
Consol. Rock Products units[35]	9-15-32	½	1	
Consol. S. & G. pfd. (Can.)	9-19-32	.....	50	50c qu. Aug. 15
Construction Mat. com.	9-19-32	¼	3	
Construction Mat. pfd.	9-19-32	2¼	4½	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[35]	9-15-32	28	33	
Coosa P. C. 1st 6's[23]	9-16-32	15	20	
Coplay Cem. Mfg. pfd.[47]	9-21-32	7	10	
Coplay Cem. Mfg. 6's, 1941[19]	9-16-32	35	45	
Dewey P. C. com.[47]	9-20-32	75	85	
Dolese and Shepard	9-19-32	14	16	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	9-19-32	.....	27	1.75 qu Apr. 1
Dufferin Pav. & Cr. Stone com.	9-19-32	.....	5	
Edison P. C. com.[47]	9-20-32	3	5	
Federal P. C. 6½'s[47]	9-20-32	50	60	
Giant P. C. com.[2]	9-19-32	½	1½	
Giant P. C. pfd.[2]	9-19-32	3	6	
Gyp. Lime & Alabastine, Ltd.	9-19-32	3½	4	
Gyp. Lime & Alabastine 5½'s[42]	9-15-32	59	62	
Hermitage Cement com.[11]	9-17-32	2	5	
Hermitage Cement pfd.[11]	9-17-32	15	25	
Ideal Cement 5's, 1943[20]	9-17-32	85	90	
Ideal Cement com.	9-19-32	8	11	25c qu. Oct. 1
IndianaLimestone 6's	9-17-32	12 actual sale		
International Cem. com.	9-19-32	10⅜	11	50c qu. Mar. 31
International Cem. bonds, 5's	9-19-32	65 actual sale		Semi-ann. int.
Kelley Island L. & T.	9-19-32	11	12	25c qu. Oct. 1
Ky. Cons. Stone com.[45]	9-19-32	1	2	
Ky. Cons. Stone 7% pfd.[45]	9-19-32	10	15	
Ky. Cons. Stone 1st Mtg. 6½'s[45]	9-19-32	15	18	
Ky. Cons. St. V. T. C.[45]	9-19-32	1	2	
Ky. Rock Asphalt com.	9-19-32	¾	1⅛	
Ky. Rock Asphalt pfd.	9-19-32	.....	25	
Ky. Rock Asphalt 6½'s	9-19-32	57	62½	
Lawrence P. C.[2]	9-19-32	12	16	
Lawrence P. C. 5½'s, 1942[2]	9-19-32	32	38	
Lehigh P. C. com.	9-19-32	8	9½	
Lehigh P. C. pfd.	9-19-32	58 actual sale		1.75 qu. Oct. 1
Louisville Cement[7]	9-15-32	60	80	
Lyman-Richey 1st 6's, 1935[13]	9-16-32	85	95	
Marbelite Corp. com.[33] (cement products)	9-15-32	5c	75c	
Marbelite Corp. pfd.[35]	9-15-32	50c	.....	
Marquette Cement com.[47]	9-20-32	4	6	
Marquette Cement pfd.[47]	9-20-32	50	55	1.50 qu. July 1
Marquette Cem. Mfg. 1st 5's, 1936[48]	9-20-32	70	.....	
Marquette Cem. Mfg. 1st 6's, 1936[48]	9-20-32	75	.....	

*Latest 1932 dividend.

Stock	Date	Bid	Asked	*Dividend
Material Service Corp.	9-20-32	4	8	
McCrady-Rodgers 7% pfd.[22]	9-15-32	20	30	87½c qu. June 30
McCrady-Rodgers com.[22]	9-15-32	No market		75c qu. Jan. 26
Medusa P. C. pfd.[47]	9-20-32	40	50	1.50 qu. Apr. 1
Medusa P. C. com.[47]	9-20-32	6½	8	
Monarch Cement com.[47]	9-20-32	55	60	
Michigan L. & C. com.[6]	9-16-32	45	.....	
Missouri P. C.	9-19-32	7	11	25c qu. Jan. 30
Monolith Portland Midwest[9]	9-15-32	60c	90c	
Monolith P. C. com.[9]	9-15-32	1	1¼	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	9-15-32	1¼	1½	40c s.-a. Jan. 1
Monolith P. C. units[9]	9-15-32	3½	4¼	
Monolith P. C. 1st Mtg. 6's[9]	9-15-32	35	40	
National Cem. (Can.) 1st 7's[34]	9-16-32	80	.....	
National Gypsum A com.[27]	9-20-32	2½	3½	
National Gypsum pfd.[27]	9-20-32	30	.....	1.75 qu. Oct. 1
National Gypsum 6's[3]	9-20-32	71½	.....	
National L. & S. 6½'s, 1941[10]	9-16-32	70	75	
Nazareth Cement com.[47]	9-21-32	3	6	
Nazareth Cement pfd.[47]	9-21-32	30	35	
Newaygo P. C. 1st 6½'s[27]	9-20-32	80	90	
New England Lime 6's, 1935[14]	9-16-32	No market		
N. Y. Trap Rock 1st 6's	9-17-32	60 actual sale		
N. Y. Trap Rock 7% pfd.[27]	9-20-32	.....	60	1.75 qu. Oct. 1
North Amer. Cem. 1st 6½'s	9-19-32	31 actual sale		
North Amer. Cem. com.[27]	9-20-32	No market		
North Amer. Cem. 7% pfd.[27]	9-20-32	¾	.....	
North Shore Mat. 1st 6's[15]	9-20-32	.....	35	
Northwestern States P. C.[47]	9-20-32	25	29	
Ohio River S. & G. com.	9-19-32	.....	5	
Ohio River S. & G. 1st pfd.	9-19-32	.....	50	
Ohio River S. & G. 6's[16]	9-17-32	25	50	
Oregon P. C. com.[9]	9-15-32	8	12	
Oregon P. C. pfd.[9]	9-15-32	80	85	
Pacific Coast Aggr. com.[40]	9-15-32	.....	½	
Pacific Coast Aggr. pfd.[40]	9-15-32	.....	1	
Pacific Coast Aggr. 6½'s, 1944[5]	9- 2-32	10	12	
Pacific Coast Aggr. 7's, 1939[8]	9- 2-32	2	4	
Pacific Coast Cement 6's[5]	9- 2-32	40	.....	
Pacific P. C. com.	9-16-32	3	.....	
Pacific P. C. pfd.	9-16-32	30	48	1.62½ qu. July 5
Pacific P. C. 6's, 1934	9-16-32	80	.....	
Pacific P. C. 6's, 1935	9-16-32	.....	94	
Pacific P. C. 6's, 1936	9-16-32	72	94	
Peerless Cement com.[1]	9-16-32	20c	40c	
Peerless Cement pfd.[1]	9-16-32	5	10	
Penn.-Dixie Cement com.	9-20-32	1½	1⅞	
Penn.-Dixie Cement pfd.	9-20-32	7	12	
Penn.-Dixie Cement 6's	9-19-32	50 actual sale		
Penn. Glass Sand Corp. pfd.[27]	9-20-32	40	50	1.75 qu. Apr. 1
Penn. Glass Sand Corp. 6's[19]	9-16-32	72½	.....	
Petoskey P. C.	9-19-32	1½	2½	
Port Stockton Cem. com.[9]	9-15-32	No market		
Riverside Cement com.[9]	9-15-32	.....	10	
Riverside Cement pfd.[9]	9-15-32	38	42	1.50 qu. Aug. 1
Riverside Cement, A[9]	8-15-32	4	6	
Riverside Cement, B[9]	9-15-32	70c	1	
Roquemore Gravel 6½'s[17]	8-20-32	75	.....	
Sandusky Cement 6½'s, 1932-37[27]	9-20-32	70	80	
Sandusky Cement 6's[19]	9-16-32	80	.....	
Santa Cruz P. C. com.	9-16-32	48	65	$1 qu. Oct. 1
Schumacher Wallboard com.	9-16-32	1⅛	.....	
Schumacher Wallboard pfd.	9-16-32	3	.....	50c qu. May 15
Signal Mt. P. C. pfd.[47]	9-20-32	5	8	
Southwestern P. C. units[47]	9-20-32	150	200	
Southwestern P. C. com.[47]	9-20-32	30	40	
Southwestern P. C. pfd.[47]	9-20-32	75	80	$2 qu. July 1
Standard Paving & Mat. (Canada) com.	9-19-32	2	2½	
Standard Paving & Mat. pfd.	9-19-32	.....	40	50c qu. Aug. 15
Superior P. C., A	9-16-32	28½	32	27½c mo. Oct. 1
Superior P. C., B	9-16-32	7	10	12½c July 20
Trinity P. C. units[47]	9-20-32	35	40	
Trinity P. C. com.[47]	9-20-32	5	8	
Trinity P. C. pfd.[47]	9-20-32	33	37	
U. S. Gypsum com.	9-19-32	23	24	40c qu. Oct. 1
U. S. Gypsum pfd.	9-19-32	100	.....	1.75 qu. Oct. 1
Wabash P. C.[21]	9-16-32	5	9	
Warner Co. com.[16]	9-17-32	2	3	
Warner Co. 1st 7% pfd.[16]	9-17-32	15	.....	1.75 qu. Apr. 1
Warner Co. 6's, 1944, w. w.	9-16-32	35	40	
Whitehall Cem. Mfg. com.[47]	9-20-32	30	40	
Whitehall Cem. Mfg. pfd.[47]	9-20-32	40	50	
Wiscon. L. & C. 1st 6's, '33[15]	9-20-32	25	.....	
Wolverine P. C. com.	9-19-32	¾	3¼	
Yosemite P. C., A com.[9]	9-15-32	*90c	1.10	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Wick & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bk. & Tr. Co., Chicago. [16]G. M. P. Murphy & Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill. [48]Hemphill, Noyes and Co., New York City.

Kentucky Consolidated Stone Company

THE Kentucky Consolidated Stone Co., Louisville, Ky., reports for the fiscal year ending April 30, 1932, a net loss of $67,902.52; however, there was an operating profit before inventory adjustment, bond interest, depreciation, depletion and taxes of $43,521.84. After payment of bond interest the working capital was reduced by $7,940.85, leaving a total working capital of $71,487.36.

As compared to the previous year there was a reduction in tonnage sold of 294,972. Of this shrinkage, 279,165 represents reduction in purchases by the railroads, of which 216,477 tons was occasioned by the completion of the heavy construction program of the C. N. O. & T. P. railroad. During the previous year this road purchased 242,695 tons, and only 26,218 tons during the past year, the project being completed early in the year.

The remainder of the shrinkage was occasioned by curtailed buying during the first quarter of the calendar year of 1932 by the Kentucky State Highway Department. A new highway commission took up its duties January 1, 1932. During the first quarter the efforts of the state legislature to transfer funds of the highway department into the general fund of the state prevented the adoption of a highway program by the new commission until after the adjournment of the legislature.

This year's operation was the first under the present management. For the first time operations were carried on under a carefully prepared budget, anticipating the conditions that actually occurred with the exception of the above mentioned interference with the highway department's program, and the actual results of the year followed very closely the budget forecast.

Greatly reduced costs were budgeted and carried out through the year's operation. There was a reduction made of 51.1% in executive salary expense and of 53.1% in clerical costs, with large savings in other departments, through lowering of wages and revision of operating methods, which resulted in a reduction of the unit cost as compared to the previous year's operation in all instances except those of fixed-cost items.

The prospects for the new fiscal year are much brighter. Under the budget for the current year additional economies have been instituted, with further reductions in executive and administrative salaries and wages. Under this budget the estimated tonnage for the year is 470,700 tons, which provides, at the estimated average sales price, operating profits sufficient to pay bond interest and yield increased working capital of approximately $10,000.

Including the tonnage shipped since the first of May the company had on its books as of July 15, 316,168.68 tons. It is evident that the budgeted tonnage for the year will be exceeded very materially, in that within two and one-half months orders have been secured for approximately two-thirds of the total tonnage estimated for the entire year.

The balance sheet as of April 30, 1932, is as follows:

ASSETS

Cash, accounts receivable and inventories	$ 122,950.70
Sinking funds	241.02
Stone deposits, plants and equipment	5,065,318.65
Deferred and other assets	144,784.64
	$5,333,295.01

LIABILITIES

Accounts payable	$ 51,463.34
First mortgage 6½% gold bonds	775,000.00
Reserves for depreciation and depletion	650,685.87
Capital stock—7% preferred	513,500.00
Surplus by appraisal	3,232,002.22
Undivided profit	110,643.58
	$5,333,295.01

Note:

Sinking fund deposit for retirement of bonds due November 1, 1931, in arrears at April 30, 1932	$35,000.00
Dividends on 7% cumulative preferred stock undeclared and unpaid at April 30, 1932	36,001.50
Preferred stock retirement fund deposits in arrears at April 30, 1932, aggregate	$26,587.52

UNDIVIDED PROFIT ACCOUNT

Undivided profit, April 30, 1931		$182,421.92
Loss for year ending April 30, 1932	$67,902.25	
Reserves for taxes and professional restored	3,937.50	
		63,965.02
		$118,456.90
Reserves for other assets, etc.		7,813.32
		$110,643.58

International Agricultural Corporation

THE International Agricultural Corp., New York City, large producer of phosphate rock and fertilizer, reports for the years ended June 30:

CONSOLIDATED INCOME ACCOUNT

	1932	1931
Gross profit	$1,441,895	$2,850,125
Expenses	1,395,943	1,897,492
Depreciation and depletion	458,712	532,363
Operating profit	(d)412,760	420,270
Other income	43,756	84,552
Total income	(d)369.004	504.822
Interest charges	428,528	448,498
Balance	(d)797,532	56,324
Profit on bonds purchased	199,762	4,353
Other profit	‡200,000	.....
Balance	(d)397,770	60,677
Provision for bad accounts	450,000	.....
Net profit	(d)847,770	60,677
Preferred dividends	.....	525,000
Deficit	$847,770	$464,323
Times interest earned	.....	1.13

‡Reinstatement, in part, of the investment in Kaliwerke Sollstedt Gewerkschaft previously written off.

CONSOLIDATED BALANCE SHEET
(As of June 30)

Assets:	1932	1931
Property account	‡$20,961,888	$24,751,479
Current assets:		
Cash	748,482	1,330,992
Accounts and notes receivable (net)	4,105,150	5,046,886
Inventories	2,784,252	3,289,297
Due from subsidiaries	722,728	944,634
*Investments	342,293	646,886
Reacquired securities	§757,910	.....
Unmined phosphate property	76,383	64,837
Deferred charges	197,274	179,488
Sinking fund cash	1,236	17
Total	$30,697,595	$36,254,516
Liabilities:		
Preferred stock	$10,000,000	$10,000,000
*Common stock	2,250,000	2,250,000
Bonded debt	6,629,100	7,112,100
Current liabilities:		
Accounts payable	139,843	285,428
Notes payable	875,000	1,000,000
Accrued interest, etc.	151,684	173,882
Insurance and contingency reserve	1,533,062	.....
Special reserve	.....	††5,466,430
†Excess assets	9,118,906	9,966,676
Total	$30,697,595	$36,254,516
Current assets	$7,637,884	$9,667,175
Current liabilities	1,166,527	1,459,310
Working capital	$6,471,357	$8,207,865

*Represented by 450,000 no par shares. †Excess assets over required declared capital. ‡Less $6,449,789 depreciation and depletion reserve. §Represents 13,951½ shares of no par common stock at cost and $635,000 bonds carried at par. ††Special reserves against plants, investments and property values.

Arundel Corp. Earnings

THE Arundel Corp., sand and gravel producer and dredging contractor, Baltimore, Md., reports for eight months ended August 31, 1932, net income of $1,099,748 after depreciation, taxes, etc., equivalent to $2.23 a share on 492,556 no par shares of capital stock, comparing with $1,524,031 or $3.09 a share in first eight months of 1931. Current assets on August 31, last, amounted to $3,916,200 against current liabilities of $383,400.

Recent Dividends Announced

Arundel Corp. (qu.)	$0.75,	Oct. 1
Calaveras Cement pfd. (qu.)	1.75,	Oct. 15
Ideal Cement com. (qu.)	0.25,	Oct. 1
Kelley Island Lime and Transport (qu.)	0.25,	Oct. 1
Santa Cruz Portland Cement (qu.)	1.00,	Oct. 1

To Increase Production of Mica Mine

THE MICA MINE, operated by A. W. Reid at Franklin, N. C., was recently described in the *Asheville Citizen*. It was opened over 50 years ago by a Dr. Lyle, of Franklin. After it had been abandoned for several years Mr. Reid reopened it in 1917, when he sold over $10,000 worth of mica. Later Mr. Reid ceased operation of the mine when foreign competition made it unprofitable. He again opened it three years ago and has been operating regularly since, and is now planning increased production.

In 1917 one block of mica was sold for $310, but the largest single block found in the last three years brought only $97.11.

Building Crushing Plant at Old California Quarry

A NEW rock crushing plant is being erected in the old rock quarry at Santa Rosa, Calif., by L. L. and A. B. Stevenson, who have purchased 10 acres of solid basalt from Nicholas Bacigalupi.

Part of the machinery at the new plant has been brought from the dismantled quarry on the A. W. Foster ranch. The new quarry will be operated with gasoline engines, and when in full operation will employ eight men.—*Santa Rosa* (Calif.) *Republican.*

Traffic and Transportation

Proposed Changes in Rates

THHe following are the latest proposed changes in freight rates up to the week ending September 17:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

26580. **Sand, common,** minimum weight 60,000 lb., from East Swanton, Vt., to Richford, Vt. Present, 4½; proposed, 70 per net ton. Reason: In order to move this business necessary to publish proposed rates which compare with present rates for same distance within N. E. on like traffic.

TRUNK LINE ASSOCIATION DOCKET

29786. **Limestone screenings,** in carloads (See Note 2), from Atlas, Hamburg and McAfee, N. J., to stations on the L. V. R. R., Easton to Tunkhannock, Penn. Rates ranging from $1.20 to $1.90 per net ton. (See Note 4.)

29788. **Stone, crushed, and coated crushed stone,** carloads (See Note 2). from Jamesville, N. Y., to Hammondsport, N. Y., rate on crushed stone $1.70 per net ton and coated stone $1.80 per net ton. (See Note 4.)

29789. **Stone, natural (other than bituminous asphalt rock), crushed,** carloads (See Note 2), from Oaks Corners, N. Y., to Hornell, N. Y., $1.30 per net ton, to expire December 31, 1932, and effective January 1, 1933, rate of $1.40 per net ton to apply. (See Note 4.)

29794. **Crushed stone (not coated),** carloads (See Note 2), from Montclair Heights, N. J., to Stroudsburg, Penn., $1, and Bartonsville, Penn., $1.10 per net ton, plus emergency charge, 6c. (See Note 4.)

29800. **(A) Sand, in open top cars,** carloads; **(B) sand, glass, engine, foundry, molding, blast, silica, quartz or silex;** carloads (See Note 2), from Tatesville, Penn., to Ellsworth, Penn., A, $1.70, and B, $2.10 per net ton. (See Note 4.)

29801. **Broken stone,** carloads (See Note 2), from St. Peters, Penn., to Wilmington, Del., 90c per net ton. Present rate, $1.05. Reason—Proposed rate is comparable with rates from Trap Rock, Penn., to Rockland, Kennett Road and Wilmington, Del.

29807. **Crushed stone,** carloads (See Note 2), from White Haven, Penn., to Benton, Penn., $1.30 per net ton. Present rate, $1.45. (See Note 4.)

29816. **Sand, common or building** (not blast, engine, fire, foundry, glass, molding or silica), carloads, and **gravel,** carloads (See Note 2), from Marlboro, N. Y., to N. Y. C. R. R. stations, Edgewood, Haines Falls, Grand Hotel Station, Roxbury, Stamford, Oneonta, N. Y., and various, rates ranging from $1.55 to $1.85 per net ton. Reason—Proposed rates are comparable with rates on crushed stone.

29822. **Sand and gravel,** carloads (See Note 2), from Alfred, N. Y., to Germania, Penn., $1.10 per net ton, subject to emergency charge of 6c per net ton. Present rate, $1.40. (See Note 4.)

CENTRAL FREIGHT ASSOCIATION DOCKET

32874. To establish on **waste stone,** viz., breakwater, chip, grout, rip rap and spauls, in straight or mixed carloads, in open top equipment (See Note 3), from I. C. R. R. stations, viz., Bloomington, Clear Creek, Quarry Jct., Dodgson and Victor, Ind., to Springfield, Ill., rate of 119c per net ton, plus emergency charge. Present, 139c.

32950. To establish on **sand,** viz.: Blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, from Points in Ohio, Pennsylvania and New York to Medina, Batavia and Rochester, N. Y., rates as shown in Exhibit A attached.

EXHIBIT A

From	To Medina, N. Y. Pres.	Prop.
Conneaut, Ohio	$2.39	$1.80
Fairview, Penn.	2.52	1.80
Swanville, Penn.	2.52	1.80
Erie, Penn.	2.50	1.80
Wesleyville, Penn.	2.50	1.80
Harbor Creek, Penn.	2.50	1.80
Moorhead, Penn.	2.50	1.80
North East, Penn.	2.50	1.80
State Line, N. Y.	2.50	1.80
Ripley, N. Y.	2.50	1.80
Forsyth, N. Y.	2.50	1.80

From	To Batavia, N. Y. Pres.	Prop.
Conneaut, Ohio	$2.39	$1.80
Fairview, Penn.	2.52	1.80
Swanville, Penn.	2.52	1.80
Erie, Penn.	2.50	1.80
Wesleyville, Penn.	2.50	1.80
Harbor Creek, Penn.	2.50	1.80
Moorhead, Penn.	2.50	1.80
North East, Penn.	2.50	1.80
State Line, N. Y.	2.50	1.80
Ripley, N. Y.	2.50	1.80
Forsyth, N. Y.	2.50	1.80

From	To Rochester, N. Y. Pres.	Prop.
Conneaut, Ohio	$2.39	$1.80
Fairview, Penn.	2.52	1.80
Swanville, Penn.	2.52	1.80
Erie, Penn.	2.50	1.80
Wesleyville, Penn.	2.50	1.80
Harbor Creek, Penn.	2.50	1.80
Moorhead, Penn.	2.50	1.80
North East, Penn.	2.50	1.80
State Line, N. Y.	2.50	1.80
Ripley, N. Y.	2.50	1.80
Forsyth, N. Y.	2.50	1.80

32956. To establish on **silica sand,** gravel or granules, carloads, minimum weight 60,000 lb., from Lac Remi, Que., to Chicago, Ill., $6.40 per net ton, plus emergency charge. Present rate, 55½c per cwt. or or $11.10 per ton (sixth class).

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

32974. To establish on **limestone, agricultural, unburned; stone, crushed; stone screenings,** in bulk in open top cars, in straight or mixed carloads, from Woodville and Gibsonburg, O., to points in Michigan (representative points shown in Exhibit B), rates as shown in Exhibit B attached.

EXHIBIT B

(To representative points in Michigan)

To	From Woodville, O. Pres.	*Prop.	From Gibsonburg, O. Pres.	*Prop.
Ann Arbor R. R. (Via Toledo, O.)				
Clare	420	145	440	155
Beulah	500	185	520	195
G. T. Ry. (Via Detroit, Mich.)				
Battle Creek	155	145	155	145
Shoup	125	117	125	117
Lum	130	125	130	125
Cass City	145	135	.....	.....
M. C. R. R. (via Toledo, O., A. A. R. R., Ann Arbor, Mich., and M. C. R. R.)				
Cassopolis	165	145	165	145
Three Rivers	155	140	155	145
Caledonia	165	145	165	145
M. C. R. R. (Via Toledo, O.)				
Utica	112	107	115	112
Otter Lake	135	125	135	135
Fergus	155	145	155	155
Auburn	155	145	155	145
N. Y. C. R. R. (Via Toledo, O.)				
Allen	125	107	125	107
Dundee	220	97	240	102
Montgomery	125	107	125	112
Morenci	260	92	300	97
P. R. R. (Direct)				
Cooper	380	145	380	155
Big Rapids	440	185	460	185
Cadillac	480	205	480	205

*Subject to emergency charge.

32930. To establish on **sand and gravel,** carloads, from Browns Siding, Ohio, to Newark, Ohio, rate of 40c per net ton, plus emergency charge. Present rate, 70c per net ton, plus emergency charge.

32963. To establish on **sand,** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica, carloads, in open top equipment, from Conneaut Harbor, Ohio, to B. & L. E. R. R. stations, via: Albion, 60c; Argentine, Branchton, 100c; Butler, 110c; Conneaut Lake, Conneaut Lake Park, Erie, 70c; Fredonia, 90c; Goff, 100c; Greenville, 80c; Grove City, 90c; Henlein, 80c; Hilliards, 100c; Kremis, 80c; Jamisonville, 100c; Linesville, 70c; Meadville, 80c; Mercer, 90c; Platea, 60c; Queen Jct., 100c; Rockdale, 110c; Shermansville, Penn., 70c per net ton, subject to emergency charges shown in C. F. A. L. Tariff I. C. C. 2525. Present—80c to Albion; 125c, Argentine; 120c, Branchton, Butler; 90c, Conneaut Lake, Conneaut Lake Park, Erie; 105c, Fredonia; 125c, Goff; 105c, Greenville. Grove City, Henlein; 125c, Hilliards; 105c, Kremis; 120c. Jamisonville; 90c, Linesville, Meadville; 105c, Mercer; 90c, Platea; 120c, Queen Jct., Rockdale; 105c per net ton, Shermansville, Penn.

WESTERN TRUNK LINE DOCKET

1601-E. Rates, **limestone, broken or crushed,** carloads, minimum weight 60,000 lb., except when marked or visible capacity of car is less, when the minimum will be the marked or visible capacity of car but not less than 40,000 lb., from Inland Jct., Mich., to Keokuk, Ia. Rates, present, class rate, plus emergency charge; proposed, 18½c per 100 lb., plus emergency charge. (By shipper.)

1601-E. **Limestone, broken or crushed,** carloads, minimum weight 60,000 lb., except when marked or visible capacity of car is less, when the minimum will be the marked or visible capacity of car, but not less than 40,000 lb. From Inland Jct., Mich., to Keokuk, Ia. Present, class rate, plus emergency charge; proposed, 18½c per 100 lb., plus emergency charge.

8110. Transit, **vermiculite,** carloads, from Parkdale, Westcliff and Hillside, Colo. At Omaha, Neb., to points beyond Omaha to which rates are applicable via Omaha as published in Item No. 2725-F of D. & R. G. W. Tariff No. 6371-B, I. C. C. No. 376. Present, no transit arrangement in effect; proposed, to publish rule to provide that vermiculite, carloads, originating at and destined to the above mentioned points may be stopped in transit at Omaha, Neb., for calcining, milling and sacking, with an extra charge to be based upon 2½c per 100 lb. at the outbound weight, observing minimum of 40,000 lb. Minimum weight, present, 80,000 lb.; proposed, 80,000 lb. into and 40,000 out of transit point.

4920-1. Rates and minimum weight, **sand, gravel and chatt, coated with oil, tar, asphalt or asphaltum,** carloads, between stations in Western Trunk Line territory. Rates, present, class rates; proposed (a) applv the single and joint line distance scale of rates which are currently applicable on coated crushed stone, on sand, gravel and chatt coated with oil, tar, asphalt or asphaltum. (b) Where present distance scale of rates on coated crushed stone are restricted to only apply from specific points of origin such restrictions to be removed for application on all of the coated products. Minimum weight, present, 40,000 lb.; proposed, same as now applicable on coated crushed stone.

ILLINOIS FREIGHT ASSOCIATION DOCKET

6827. **Sand and gravel,** carloads (See Note 3), from Allison Branch, Ill., to various points in Illinois:

To (rep. points)	Rates per net ton Pres.	Prop.	To (rep. points)	Rates per net ton Pres.	Prop.
Huegely	*	$1.13	Mo.-Ill. Shops	*	1.26
Oakdale	*	1.13	Collins	*	1.26
Sparta	*	1.13	Chester	*	1.26

*Classification basis.

6836. **Stone, crushed** (in bulk), **rough** (not dimension or dressed), **rubble, rip rap, quarry strippings and limestone, unburned agricultural** (in bulk in open top cars only). (See Note 3), from Lehigh. Van's Siding and West Kankakee, Ill., to points in Illinois (rates per net ton):

To	Pres.	Prop.	To	Pres.	Prop.
Bonfield	70	45	Mazon	76	45
Essex	70	45	Wauponsee	76	45
Coster	70	45	Laugham	76	45
Gardner	76	45	Seneca	76	45
Booth	76	45			

I. C. C. Decisions

24618. Crushed Stone. John S. Lane & Son, Inc., vs. N. Y. N. H. & H. et al. Dismissed. Rate on crushed stone from Westfield, Mass., to White Plains, N. Y., was found not unreasonable or unduly prejudicial.

Flourspar Rates to Be Increased

INCREASED ex-river rates on fluorspar, in carloads, from various ports on the Ohio and Monongahela rivers in Ohio, Pennsylvania and West Virginia to destinations in Ohio, Pennsylvania and West Virginia went into effect September 16. The proposal of railroads to increase the rates was held justified by the Interstate Commerce Commission in a decision made public September 10.

The present rates range from 46 to 56% of the sixth-class rates and from 13 to 16% of the first-class rates. The new rates are approximately 75% of the sixth-class rates and 21% of the first-class rates. The railroads said that based on $20 a ton, the cost of the fluorspar used in the production of steel would amount to only 8 c. They estimated that the higher rates will increase the cost of fluorspar at destinations on an average of about 60 c. a ton. Accepting these conclusions, the commission declared that it is apparent that the increased cost from the higher rates could not be detected in the price of steel.

The fluorspar moving under the ex-river rates is usually purchased f.o.b. mines in northern Kentucky and southern Illinois, transported in open barges to the river ports where it is unloaded directly from the barges into open-top cars and thence moved by rail to the destinations.

The increases in rates per net ton range from 40 c. to 90 c. a ton.

A few of the proposed rates are lower than the present rates, this being due to the fact that the present rates are on the full sixth-class basis. From Cincinnati to numerous points in Ohio, West Virginia and Pennsylvania, the carriers will cancel their present ex-river rates and apply instead sixth-class rates.

Reduces Blasting Cap Accidents

THE INSTITUTE of Makers of Explosives reports that during the first six months of 1932 there was a decrease of 53 1/3% in blasting cap accidents to children as compared with the number reported during the same period of 1931. In the hopes of still further reducing the accidents, the Institute has enlisted the support of superintendents of public instruction in the various states, their teachers; the Department of Agriculture, the Bureau of Mines, at Washington; boy scouts and girl scouts, and safety organizations of various states. A special plea is made to all users of explosives to see that blasting caps are kept out of the reach of children.

R. F. C. Organizes for Small Project Loans

THE Reconstruction Finance Corp. has set up an organization intended to facilitate and expand its self-liquidating loans in so far as they relate to small projects.

Harvey C. Couch, a director, stated that the corporation desires to speed up this particular phase of its work all along the line with a view to getting many small projects under way with the realization that a volume of such undertakings will be as beneficial as several large projects.

Accordingly, the corporation has secured the services of leading engineers to assist in handling applications for self-liquidating construction projects.

In this connection it was stated that the corporation will endeavor to assure the financial integrity of such projects in order that the securities will make investments attractive to the public at a later date.—*Wall Street Journal* (New York City).

Plan Lime Plant in Missouri

SOME WEEKS AGO a party of men representing a Kansas City, Mo., company engaged in the manufacture of lime were in Seneca, Mo., and made an investigation of the various strata of limestone to see if any of them are of lime producing rock. Several tracts of land were investigated and a lease has been closed for a tract of the Laura Deweese farm.

A thorough investigation and test of the rock will be made and if found satisfactory and the quality of lime desired can be produced, a lime plant will be built and the production of lime on a large scale will be engaged in.—*Seneca* (Mo.) *News.*

Leaves Idaho Portland Cement

J. B. MAXFIELD, vice-president and manager of the Idaho Portland Cement plant at Inkom, has resigned, the change taking effect September 3. Mr. Maxfield has been manager of the Inkom mill since its installation and was one of the men active in its organization.

R. Enloe, who is secretary-treasurer of the company, is acting as temporary manager of the plant at the present time.

The mill, which opened August 1, after a temporary shutdown, will operate until December at least, Mr. Enloe said.—*Pocatello* (Ida.) *State Journal.*

Build Fluorspar Plant

A GROUP of California men, headed by Cooper Shapley of Bishop, have taken an option on a fluorspar property near Deming, N. M. They are building a mill to crush and refine mineral by flotation, producing a product of 90% purity.—*Carrizozo* (N. M.) *Outlook.*

Recommends Investigation of Fertilizer Possibilities for State Cement Plant

THE Michigan State Prison Commission has recommended to the state administrative board that it appropriate $10,000 to meet the estimated cost of experiments in the production of commercial fertilizer at the state-owned Chelsea cement plant, which has not been in operation for some time.

Machinery in the Chelsea plant is claimed to be suitable for making the fertilizer, and the type of fertilizer proposed is one which is being manufactured and used successfully in other parts of this country and in Europe.

The commission suggests as a means of raising the $10,000 for experimental purposes that the administrative board authorize the sale of $10,000 worth of cement now on hand at the Chelsea plant, where, it is estimated, approximately 75,000 bbl. are stored. —*Michigan Contractor and Builder.*

Says State Has Spent No Money to Transform Cement Plant

JOHN W. MINER, chairman of the Michigan State Prison Commission, on August 31, wrote John L. Lovett, general manager of the Michigan Manufacturers' Association, Detroit, saying that no money had been spent in the development of a fertilizer project at the Chelsea cement plant. He also denied a report that the state had paid an Ann Arbor professor for work on the project.—*Detroit* (Mich.) *Free Press.*

Silicosis in Wisconsin Industry

AN AVERAGE of $10,000 a case has been paid to 22 men affected by silicosis, according to a report of the Wisconsin Industrial Commission on cases during the three-year period 1929-1932. The commission reported that victims of silicosis has worked an average of 19.7 years in the marble and granite works; 15.9 years in iron and steel foundries; 8.9 in enamelware manufactures, and one case in a quartz mill, 14 years. Average age of employes in these cases ranged from 40 to 50 years.

The Wisconsin commission has an order providing that exhaust systems be placed on all equipment and processes creating and throwing off injurious dusts.—*New York* (N. Y.) *Journal of Commerce.*

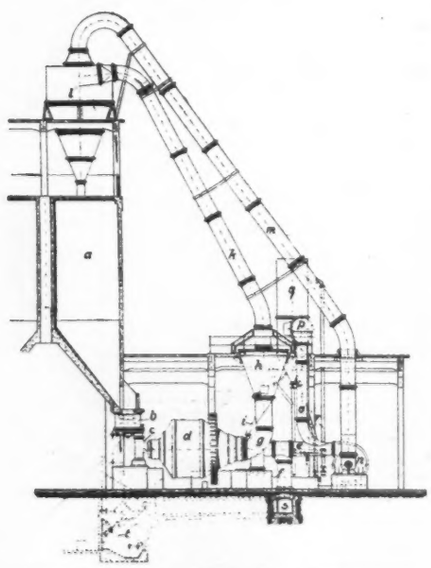
M. A. Reeb

M. A. REEB, formerly president and general manager of the Niagara Gypsum Co., Buffalo, N. Y., died on September 9. Mr. Reeb was interested in this business for many years but discontinued his activities when the company was acquired by the United States Gypsum Co. He is survived by his widow and four daughters.

Foreign Abstracts and Patent Review

Tube Mill With Air Separation and Drying System. W. Jaedel describes the first Krupp tube mill with air separation and mill-drying system erected some time ago at the Wittekind cement plant. The raw hard lime marl is precrushed to about 300 mm. (12 in.) in a jaw crusher. After the necessary coke has been added, it is crushed to 0.0 to 80 mm. (3 in.) in a hammer mill, and then delivered to the reserve bin of the closed-circuit grinding mill with air separator and mill drying system shown in Fig. 1. This installation consists of the reserve bin *a*, the air tight plate feeder *b*, the charging slide *c*, the mill *d*, the pneumatic duct *e*, the discharge bend *g*, the separator *h*, the coarse meal return *i*, the pipe line *k* for raising fine meal, the cycline *l*, the return air line *m*, the mill fan *n*, the air vent duct *o*, the air discharge fan *p*, the wet dust eliminator *q*, the slurry water circulating pump *r*, the hot air duct *s* and the stair-step grate furnace *t*, which supplies the heat to evaporate the water in the raw material. The pressure in the mill is less than atmospheric so that no dust is discharged into the operating room. The slurry water is used to moisten the raw material before charging it into the shaft kiln, to save the dust. All machines are driven by direct-coupled electric motors.

The mixture of raw meal and coke passes from the grinding drum to the screening chamber of the mill from which blades cast it into the air current which picks up the fine meal while the coarser meal is returned to the mill. The air current delivers the fine material to the separator where the coarser meal is separated from the finer meal to be returned to the mill with the other coarse meal. The fine meal is delivered to the cyclone where it is separated from the air and drops into the silo, while a fan returns the air to the mill. The water in the raw meal is evaporated by the hot gases produced in a stair-step grate furnace and supplied to the air current just ahead of the mill. A screw fan draws a certain amount of air from the circuit and forces it through the wet dust eliminator into the atmosphere. At the same time this fan supplies the necessary vacuum for drawing the drying gases into the mill system. The dust eliminator is supplied with water from a centrifugal pump in a closed circuit and the slurry water is supplied to the raw fine meal before it enters the shaft kiln, so that the dust is reclaimed.



Installation of tube mill with air separation and drying system

Many tests and measurements on the installation gave the following data: The mixture of lime marl and about 10% coke has a granular size of 0 to 80 mm. (3 in.) and a moisture of 4 to 6%. The mill, having 3 m. (10 ft.) inside diam., with 18 tons of balls of 40 to 80 mm. (1½-3 in.), has a speed of 18.5 r.p.m., a load capacity of 270 hp., and an output of 18 to 22 tons per hour, depending on fineness. The fan has a capacity of 45,000 cu. m. (1,589,170 cu. ft.) per hr., a total pressure of 510 mm. (20 in.) of water gage, and a load capacity of 125 hp. and an efficiency of 0.68. Raw meal has a fineness of 22% average residue on the 4900 mesh (178 mesh). Lime marl and coke of a moisture of 0.4 to 0.8% are used. Heating gases of 310 to 500 deg. C. are added, amounting to 7500 to 8500 deg. kg. (16,500-18,700 lb.) per hr., depending on moisture. Temperature of the circulating air is 115 deg. C. at the mill inlet and 78 deg. C. at the mill outlet; exhaust air before entrance to the wet dust eliminator at 60% saturation has a temperature of 55 deg. C. From 600 to 1000 kg. (1320-2200 lb.) of water is evaporated per hour, depending on moisture. From 900 to 1000 calories (3600-4000 B.t.u.) of heat are required per kg. (2.2 lb.) of water evaporated. — *Tonindustrie - Zeitung* (1931) **55**, 82, pp. 1147-1149.

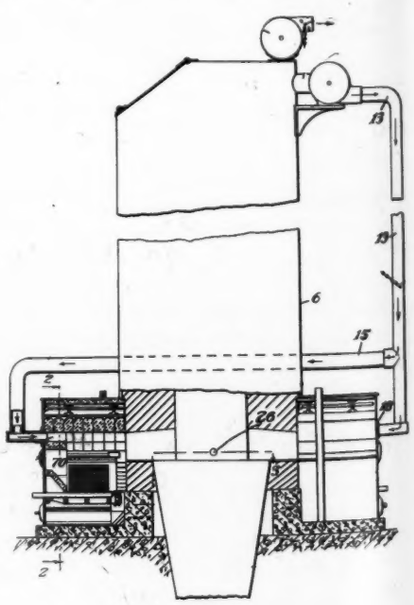
Contribution to the Hardening Problem. Kurt Wuerzner regards the experiences of investigators of the crystalline and of the colloidal theories of hardening from a viewpoint which embraces both theories. It has been stated often that this or that synthetically produced compound shows no hydraulic properties, and therefore is not the essential in portland cement. But this statement is not valid in its generality; not the compound as such determines the hardening, but the physical conditions under which it enters in reaction, and which either do or do not lead to hardening.

If the physical forces are credited with a decisive role, there need be no hesitation to assume that a conversion of the clinker matrials down to their basic substances, lime, silicic acid, ferric oxide and alumina, can proceed with phenomenas of hardening. A test procedure with results is given and if the results are applied to conditions encountered in a cement mixed with water, there appears a great probability that a conversion of the clinker particles results by way of the hydro compounds down to the basic substances. Therewith the question is left open as to whether or not there can simultaneously appear a building up in the course of time, for example, an adsorption-compound of the lime with the expelled silicic acid.—*Zement* (1932) **21**, 17, pp. 243-245.

Recent Process Patents

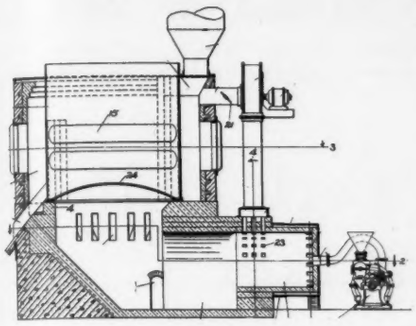
The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Lime Kiln. The inventor says the object of his invention is to burn lime with coal and give it the same qualities as those of lime burned with wood. The difference between this kiln and other vertical kilns is in the furnace, which has a flat arch and a system for recirculating the flue gas. There is a temperature regulator operated by a pyrometer which controls the flow of the flue gas. There is also a pressure regulator subject to gas pressure variations and a stack draft control operated by the pressure regulator.—*Robert Thomas Haslam, Assignor to Rockland and Rockport Lime Corp., Rockland, Maine, U. S. Patent No.*



Recirculates flue gas

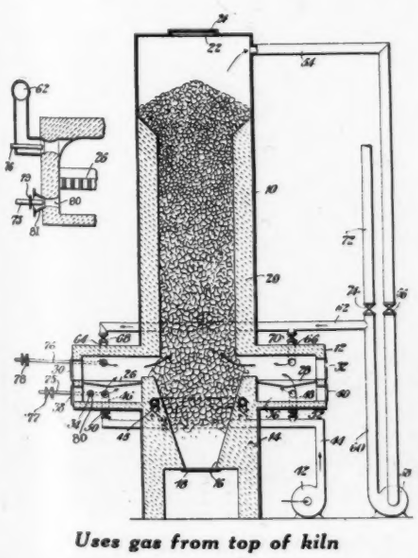
Gypsum Calcining Furnace. The type of furnace shown is intended particularly to be fired with powdered coal. In order to control the heat so that it shall not become too strong on the kettle bottom, the inventor



Burns powdered coal

takes out a portion of the furnace gases and conducts them back to the furnace. This is to prevent the intense flame effect which ordinarily results from burning powdered coal. *Joel Eklund, Assignor to Erie City Iron Works, Erie, Penn., U. S. Patent No.* 1,841,940.

Method of Burning Carbonate Rock. This invention is a lime kiln and the claims cover the removing of gases from the top of the kiln and introducing part of the same gases at the furnace, thus keeping the pressure where the gases reenter the kiln at 2 to 3 in. of water below the atmospheric pressure. The pressure at the top of the kiln should then be about 4 in. below atmospheric pressure. The kiln is a straight shaft with two furnaces on opposite sides of the shaft. The admission of primary air for combustion is through pipes and valves shown, and steam may be admitted above and below the grates by valves (77) and (78). The gases are drawn from above the charge through a pipe (54) that goes to a blower. The blower discharges part of the gases through valves (68 and 70) to openings above the grate in the furnaces, and the remainder goes through another valve (74) to a waste pipe. By regulating these valves the desired pressure is obtained. The air for combustion is put into the furnace by a blower (42), and this air may be preheated by passing it through a pipe (45) that runs around the hot lime compartment.—*George H. Niles, Assignor of one-half to Doherty Research Co. and one-half to Arthur E. Truesdale, U. S. Patent No.* 1,798,802.



Uses gas from top of kiln

Feeder. This feeder has a hopper connected to a box in which is a double opposed screw. It also has a provision to let air out. From this screw the slurry passes through a gate to another screw which conveys it to the kiln. The screws are geared so that the double opposed screw is driven at half the speed of the lower screw.—*Clinton P. Harris, Assignor to Huron Industries, Inc., Alpena, Mich., U. S. Patent No.* 1,831,561.

Preventing Incrustation on Cement and Concrete. Patentee says incrustation, also called "carbonatation," may be prevented by the use of compounds which form insoluble compounds with free lime. He prefers to use ammonium carbonate, but mentions borax, ammonium phosphate, metaphosphate and pyrophosphate, urea, ammonium carbamate and ammonium bicarbonate as other materials that are effective. Calcium hydrogen phosphate may also be used as a substitute for neutralizing the calcium hydroxide formed and yielding an insoluble compound. Certain dye stuffs like Caledon green, red and blue, iron oxide and chrome green may also be used.

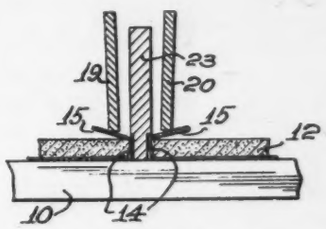
If cement is to be gaged with water containing ammonium carbonate between 3 and 5% of the weight of the cement should be used in a saturated solution and the mixing should be rapid and efficient. The first set occurs in a few minutes and should not be disturbed or it will fail to set hard. It becomes hard in a few days. The final strength of the cement or concrete is slightly raised and the inventor ascribes this to the formation of a colloidal envelope around the cement particles.

To prevent cracking, 100 parts of cement and 50 parts of water are applied as a slurry after the surface to be treated has been wet. As soon as it has been applied it is sprayed rapidly with a saturated solution of ammonium carbonate which is rapidly worked in with a brush. Recently made concrete may be painted with a saturated solution which is worked in with a brush. Colors like Caledon green may be used taking 2.5 parts green and 2.5 parts ammonium carbonate to 100 parts of portland cement and 200 parts of sand or other aggregate. As much as 7.5 parts of color may be used. Ten parts of Caledon purple paste and 5 parts ammonium carbonate may be used with 100 parts portland cement and 300 parts marble chips. Commercial ammonium carbonate may be used and the patent gives directions for adding it dry as well as wet. The claim covers only the use of ammonium carbonate for preventing incrustation on set cement and the use of 3 to 5% of ammonium carbonate with a cement containing free lime and vat dye stuff colors reacting to form a colloidal precipitate binding the color. *Gerald Noll White, U. S. Patent No.* 1,824,854.

Apparatus for Heating Cement Raw Material. Waste gases from the kiln are used to preheat dry cement raw materials in this invention. It is placed in the base of the stack. A plunger pump moves the material through coils in the preheater and also regulates the feed to the kiln.

The inventors claim that as soon as the material becomes heated it will flow through these coils like a liquid, also that it is forced forward by the expansion of air in the voids of the material. The heated gases pass around and through the coils, and if necessary the flow is aided by a blower. The inventors say that there is a difference in the temperature to which the materials may be preheated, due to differences in the physical and chemical characteristics. But it is desirable to heat it as hot as possible without destroying the flowing properties.—*David J. Uhle and Max E. Gruenwald, U. S. Patent No.* 1,801,467.

Folding Device for Plaster Board Machinery. In making plaster board of narrow widths, such as 16-in., it is desirable to make two strips at once. To do this requires a double folding device in the center of the machine, and it is this which is covered by the patent. The cut shows a section through the folder and the edges of the two strips of board just before the fold is completed.—*C. Absmier, Assignor to United States Gypsum Co., Chicago, U. S. Patent No.* 1,824,420.



Double folding device for 16-in. wallboard

Drying Process. This process is adapted to any moving strip or continuous sheet, and is designed especially for drying paper. The strip is passed through a succession of chambers, each of which is hotter than the preceding camber. With paper the partitions are formed by the paper itself. Substantially the same body of air is used all the time, passing through one chamber and being reheated and then into the next chamber. When it is saturated with moisture the air is sent to a condenser where the moisture is taken out. Then the air is heated and sent back into the system.—*John P. Brown, U. S. Patent No.* 1,798,718.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

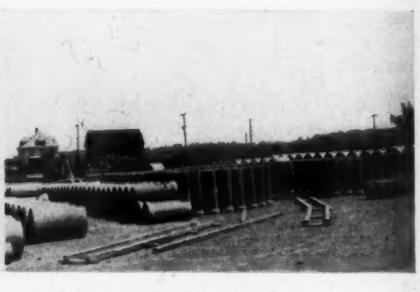
Crushed Stone Producers Work With Concrete Pipe Manufacturer

Wagner Quarries Co., Sandusky, Ohio, and Dolomite Products Co., Rochester, N. Y., Furnish Sites and Aggregates

By R. P. Brown

SINCE OPENING its plant at Sandusky, Ohio, the Universal Concrete Pipe Co. has been operating seven days a week. That shows what the combination of a good product, a live sales organization, and a modern plant can do, even under present conditions.

This plant is the seventh link in a chain of plants which the company has developed in recent years. This development has been centered around a belief that properly located plants equipped to manufacture a product of high quality can operate profitably under capable direction. One interesting feature in the past development of this chain is that almost invariably its plants are located on property of either sand and gravel or crushed stone producers.



At left, pipes for spray curing. At right, stock piles at plant

Development of Company

The development of the company is illustrated by reviewing the plants which it has designed and built. The organization began at New Martinsville, W. Va., from which it still operates. Its second plant was built at Louisville, Ky. This plant was sold and is now operated as the Kentucky Concrete Pipe Co. Plants were then opened at Columbus and Cleveland, Ohio, and at Pittsburgh, Penn. A sixth plant opened at Philadelphia was sold and is now the Concrete Products of America.

The seventh plant, at Sandusky, a description of which follows, is located on property of the Wagner Quarries Co., and its eighth plant, which was opened late in May at Rochester, N. Y., is at the quarry of the Dolomite Products Co. The seventh and eighth plants are practically alike, being based on the experience gained in the design and operation of the earlier plants.

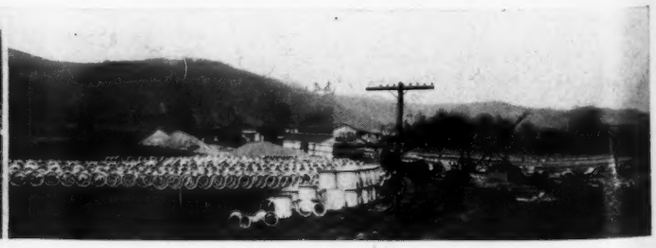
The Sandusky plant consists of a steel frame, monitor type building 80 x 120 ft., with concrete block walls. It is on a five-acre tract just outside of Sandusky. The mixing and tamping equipment is located in the rear of the building near a door which allows sand, cement, and stone screenings to be trucked in. This leaves the whole front end of the building free for curing space and transfer to yard storage is through a large door at the front.

Cement and sand are purchased through local dealers in Sandusky, being delivered by truck, and stone screenings are secured from the Wagner quarry. Coarse, washed lake sand, and No. 46 screenings are used exclusively, for all sizes of pipe, and either Medusa or Castalia portland cement.

Plant Equipment

The pipe machine is a specially designed unit manufactured by the Universal Concrete Pipe Co. at New Martinsville, W. Va. It combines both the mixing and tamping equipment into a single, compact, closely coordinated unit. Forms, cores, etc., are also manufactured by the company at its home plant. The mixer, which is a one bag Ideal unit, is mounted on an overhead platform, 15 ft. above floor level. The skip is filled at floor level, where it rests in a pocket in the concrete floor to facilitate loading and at the

General view of Pittsburgh plant



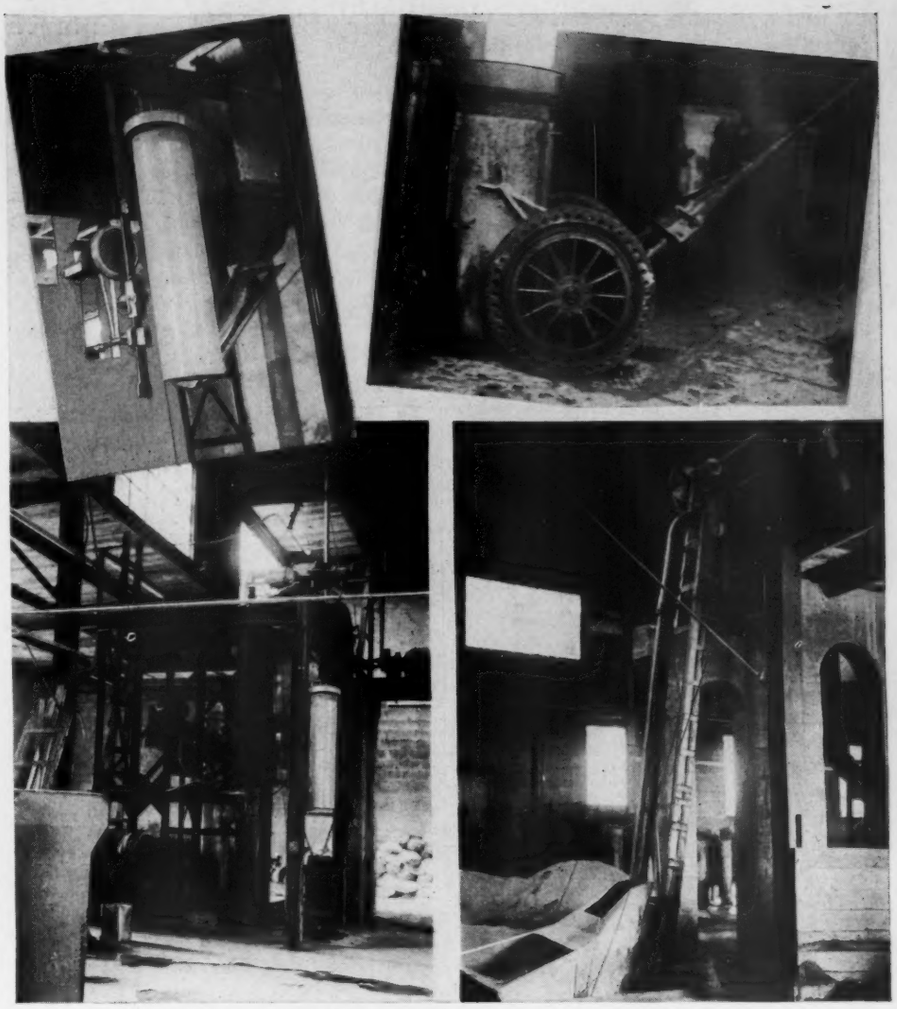
Stock pile and plant at New Martinsville

same time to avoid damage from battering of the wheelbarrows as they are dumped.

All equipment is electrically operated, and the mixer man controls the skip, water supply, and mixer, keeping a supply of mixed concrete on hand at all times. Two minute mixing is required. Because of the high-speed, heavy tamping that the pipe receives, a particularly dry concrete must be used, the consistency being such that a handful of the mix, when squeezed in the hand will not show any free moisture, and in fact, will hardly cling together. Only enough water to hydrate the cement is added for mixing, curing water being supplied by sprinkling after the pipe is in storage.

From the mixer the dry concrete is discharged to a small storage hopper. This in turn feeds an 8-in. screw conveyor, which takes the mixed concrete to the chute feeding the tamper. This conveyor is under the control of the mixer operator, who keeps a steady supply of concrete feeding to the pipe molds at all times, but not so rapidly as to prevent the pipe from being thoroughly tamped in 2-in. lifts, or to spill over the sides of the form. The operator's position on top is such that he can see all operations without moving.

The pipe machine is capable of making all pipe sizes between 8 in. and 30 in. in diameter. Each size of pipe requires a special form and core. The forms are made of $\frac{1}{16}$-in. galvanized sheet steel, with $\frac{3}{8}$-in. cast steel sections for the base and bell. Special lugs are fastened to the sides to fit the pipe carrier, which facilitates handling from the machine to the plant storage space. The carrier, which is mounted on Ford pneumatic tires, was developed by the company and will handle sizes of pipe up to 36 in. in diameter.



Above, at left, core and tamper. At right, pipe carrier. Below, two views of the concrete pipe machinery

Base plates, or pallets, are mounted on a revolving table centered under the core. The pipe forms are in turn assembled above the base plate, the core lowered, and the whole unit revolved while the pipe is being made. The table is driven by a 7½ hp. three phase, 60 cycle, 220 volt Westinghouse motor connected to the table driving gear through a V-belt drive. The motor is a constant speed unit, but the speed of the table can be varied by shifting the gears which connect the table mechanism to the drive shaft. The rate of speed depends upon the size of the pipe being manufactured.

All pipe are made in 4-ft. sections, and a tamping unit is mounted about 7 ft. above the floor. This consists of a 3 hp. motor connected through a speed reducer to a 12-in. flywheel, on which is mounted the tamping bar. This bar is 4 in. wide and ½ in. thick, with a tamping spade at the bottom. It is 10 ft. long, which allows it to be lowered to the bottom of the pipe form, or raised as required without affecting the weight or direction of the stroke. The whole mechanism can be moved forward or back by means of a screw, the position being determined by the size of pipe being produced and whether it is plain or reinforced. In making plain pipe the tamping bar is adjusted to strike in the middle of the space between the core and the form, but when heavy reinforced pipe is being made the concrete is tamped on both sides of the reinforcing steel in order to insure uniform, maximum density. The core is raised by a Shepard hoist when the bell has been completed and the pipe removed with the carrier.

Assembling and stripping forms takes less than a minute for the smaller sizes of pipe. The forms are designed to be easily opened or closed by hand without wrenches or special tools. Top, bottom, and center clamps are all connected by a bar, which when swung releases or closes them. The green pipe stays on the pallet during the time it is held in the plant. As the pipe are transferred to yard storage these pallets are cleaned and stacked near the machine for use again.

Interesting Curing Methods Practiced

Special provision is made to see that all units are cured under the most favorable conditions. In the curing room a series of perforated, galvanized pipes are mounted about 8 ft. above the floor level on the building columns, which are set on 16 ft. centers, and water is turned on four times a day for half an hour at a time. The city pressure is such that this grid of spray pipes covers the entire storage area with a fine spray. As all pipe stay in the factory for at least four days before going to yard storage, they are amply strong to be handled, and the percentage of breakage is negligible.

The plant crew consists of the mixer man, the operator who controls the revolving table and tamper, and two helpers, one who handles the bell forms and another who takes the pipe away from the machine. When making small pipe, the mixer operator also comes down and loads sand and cement into the skip, and the bell man measures out the stone screenings and loads them into the skip. When making reinforced pipe an extra man is required to handle the reinforcing steel.

Large units 30 to 84 in. in diameter are made outside the plant building. A 2-bag Jaeger mixer is mounted behind a trackway on which a traveling bucket moves on rails. This runway is about 6 ft. above ground level. The pipe molds are assembled on pal-

lets on the ground and concrete fed to them from the traveling bucket. As these pipe are all large and are all reinforced, a slightly damper mix is used than for the machine made units. Hand tamping under the constant supervision of a foreman is practiced for all yard work, particular care being exercised to see that the pipe walls are thoroughly and uniformly tamped. No waterproofing compounds are used in any pipe, as the mix is rich and the tamping thorough.

Pipe at this plant are made to conform to the specifications of the American Concrete Institute and the Ohio State Highway Department, and as most of them are sold to the state and county, tests are made by the state officials. Sand, stone, and cement are purchased to meet state specifications, and sieve tests are made by the company at regular intervals. Ever since the plant has been in operation it has been a problem to keep a stock in advance of requirements, and state tests made on 14 day old pipe show ample strength to meet all requirements. This has created a favorable impression which is reflected in sales to municipal and county officials who are not in a position to make their own strength tests. These officials know that all pipe are made to meet state tests. Positive evidence of the maintained quality of its pipe is afforded by permitting state inspectors to take samples at random and at irregular intervals.

Harry Leuliette is the northern Ohio district manager for the Universal Concrete Pipe Co., and has charge of both the Sandusky and Cleveland plants.

Ohio Company to Produce Sand and Ready-Mixed Concrete

WITH the incorporation of the Buckeye Sand and Supply Co. of Bellaire, Ohio, it became known that the new company has leased a part of the land formerly occupied by the Carnegie mill and in addition to the ground space will also make use of one of the small brick buildings for an office. The old docks will also be used for river shipments, incoming and outgoing.

Storage bins will be provided, as will necessary loading and unloading equipment.

Ross Neal will be the manager for the company. The company will be engaged in the sale of sand, gravel and ready mixed concrete, with deliveries to be made in trucks, barges and by rail.—*Bellaire* (Ohio) *Leader.*

Concrete Paving Yardage

CONCRETE PAVEMENT yardage as awarded in the United States during August and for the period ending September 3, as reported by the Portland Cement Association, follow:

	Yardage awarded during August, 1932	Total yardage awarded September 3, 1932
Roads	11,136,778	57,806,995
Streets	1,086,311	5,744,252
Alleys	51,500	259,573
Total	12,274,589	63,810,820

Recent Prices Bid and Contracts Awarded

Washington, N. J. The common council has awarded a contract for 300 tons of bituminous macadam stone to the Hutchinson Co. of Aldan, Penn., on a bid of $4.18 a ton, delivered on the street. The Vitrodite Paving Co. of Bethlehem, Penn., bid $4.74.

Fargo, N. D. The Muskoda Sand Co. and Kost Bros. were recently awarded a contract for furnishing 6000 cu. yd. of highway gravel. Their bid was $1.59 a cu. yd. delivered at Pinkham.

Washington, D. C. The Department of the Interior expects to consummate a contract with four California cement companies to supply 380,000 bbl. of cement to line the four Boulder Dam diversion tunnels. Reports indicate that the companies are Riverside Cement Co., of Riverside; California Portland Cement Co., of Colton; Monolith Portland Cement Co., Monolith, Calif., and Southwestern Portland Cement Co. of Victorville. The four companies submitted a joint bid of $2.22 a bbl., which was 17 c. a bbl. below the next lowest bidder.

Rifle, Colo. Hinman Bros. Construction Co. of Denver were the low bidders recently on the gravel surfacing of 6.46 mi. between New Castle and Glenwood canon. Hinman Bros. made a bid of 33 c. on unclassified yardage.

San Francisco, Calif. Three portland cement companies submitted bids September 6 for furnishing more than 500,000 bbl. of cement for the completion of the Coast Range tunnels of the Hetch Hetchy water system. None of the bids were submitted upon the official blanks, as required by the call for bids, and T. A. Brooks, city purchasing agent, declared that none had fulfilled the terms of the call and that consequently, in his opinion, it was a case of "no bids." Bulk prices per barrel submitted by the three companies for f.o.b. delivery at three different points were as follows: Pacific Portland Cement Co.—Moy, $1.98; Sunol, $1.94; Livermore, $1.96. Cowell Portland Cement Co.—Moy, $2; Sunol, $1.96; Livermore, $1.98. Yosemite Portland Cement Co.—Moy, $2.08; Sunol, $2.04; Livermore, $2.06.

Marysville, Kan. The county commissioners have signed a contract with the Blue Rapids Gravel Co. whereby gravel will be delivered to benefit districts Nos. 11 and 12 for $1.75 per cu. yd. A sum of 85 c. per cu. yd. is to be paid for the gravel at the pit and 90 c. per cu. yd. for hauling. The average haul will be 18 mi.

Minneapolis, Minn. The city council's good roads committee has recommended purchase of 2900 cu. yd. of crushed limestone from the Landers-Morrison-Christenson Co. at 85 c. per cu. yd. at the pit. This company made the only bid.

Freeport, Ill. Contracts for the building of approximately 19 mi. of gravel road in Stephenson county were awarded to the following: P. R. Aman, Elkhorn, Wis., was awarded the following contracts: 5000 yd. in Waddams township at 64 c. per yd., 5000 yd. in Rock Grove township at 69 c. per yd., 1000 yd. in Rock Grove township at 74 c. per yd. The firm of Ryan and Dahl, Stoughton, Wis., was awarded the contract for 1000 yd. in Winslow township at 84 c. per yd.

Sand-Lime Brick Production and Shipments in August

THE FOLLOWING DATA are compiled from reports received direct from producers of sand-lime brick located in various parts of the United States and Canada. The accompanying statistics may be regarded as representative of the industry.

Fifteen sand-lime brick plants reported for the month of August, this number being two less than the number reporting for the month of July, statistics for which were published in our issue of August 13—revised statistics as given below.

The number of producers reporting this time being less than for July, we have estimated figures for the plants for which reports have not been received, and the totals indicate that production in August remains about the same as in the previous month. Rail and truck shipments show an increase. Stocks on hand remain about the same, while an increase is shown in unfilled orders.

Average Prices for August

Shipping point	Plant price	Delivered
Boston, Mass.	$ 8.00	$10.00
Detroit, Mich.	.....	12.50
Flint, Mich.	11.50	.....
Grand Rapids, Mich.	10.00	.....
Milwaukee, Wis.	8.50	10.50
Mishawaka, Ind.	8.00	.....
Pontiac, Mich.	10.50	12.50
Saginaw, Mich.	10.00	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Ont., Can.	12.00	13.50

Statistics for July and August

	†July	*August
Production	3,222,749	2,537,173
Shipments (rail)	194,400	175,880
Shipments (truck)	2,057,295	2,508,457
Stocks on hand	5,282,186	4,150,913
Unfilled orders	5,820,000	5,923,000

†Seventeen plants reporting. Figures revised to include statistics from two plants not reportitng in time to include with previous published figures for this month. Incomplete, six not reporting unfilled orders.

*Fifteen plants reporting. Incomplete, five not reporting unfilled orders.

Ohio Ceramic Industries Association Announces Program

THE PROGRAM for the annual fall meeting of the Ohio Ceramic Industries Association to be held at Columbus October 14-15 has been issued. The meeting will include the Michigan-Ohio football game.

Of special interest will be the discussion of "Ceramics and the Program of Fabricated Houses." This will be discussed by G. A. Bole from the research man's viewpoint and by O. W. Renkert, president of the Metropolitan Paving Brick Co., from the manufacturer's viewpoint.

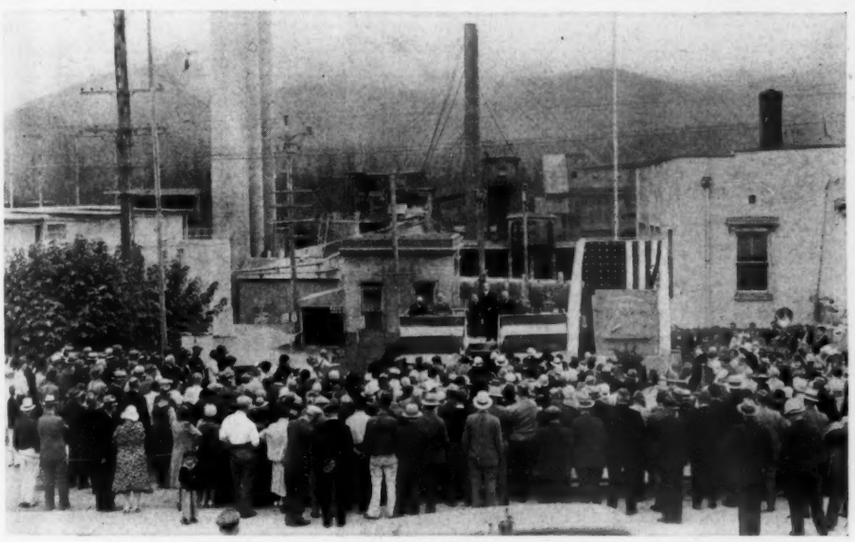
Washington Plant Dedicates Trophy

IN THE PRESENCE of a large and enthusiastic crowd of mill employes and their families and friends, western Washington cement officials, invited guests including Governor Hartley, public officials of Concrete and surrounding communities and interested industrialists, the Concrete (Wash.) plant of Superior Portland Cement, Inc., dedicated its Portland Cement Association safety trophy on August 11.

James H. Kane, Seattle attorney and member of the board of directors of the Superior Portland Cement, Inc., gave the address of welcome.

C. N. Reitze, vice-president and general manager of the company, then introduced F. J. Barrett, district engineer of the Portland Cement Association, who presented the trophy. The trophy was unveiled by Misses Mary Bailey and Mary Holyfield, daughters of employes. H. A. Ambler, general superintendent of the Concrete plant, accepted the trophy for the employes and the company.

C. L. Wagner, vice-president in charge of operations, Superior Portland Cement, Inc., introduced Gov. Roland H. Hartley, whose talk was enthusiastically received. In the evening everyone gathered at the Legion hall for a dancing party as guests of the company.



Safety trophy dedication at plant of Superior Portland Cement Co., Concrete, Wash.

To Report on Dust Hazard in Industry

A SYMPOSIUM of the dust problem in industry is one of the interesting features scheduled for the Industrial Health Section meetings at the Twenty-First Annual Safety Congress and Exposition which meets in Washington October 3.

The entire Tuesday afternoon session will be devoted to the dust problem in a joint session with the Metals Section.

Dr. L. U. Gardner, Director of the Trudeau Laboratories, Saranac Lake, N. Y., will discuss the action of various dusts on the lung tissues. His talk will be followed by a discussion of the dust content of the atmosphere in various dusty industries by J. J. Bloomfield, U. S. Public Health Service, Washington. Dr. A. E. Russell, also of the U. S. Public Health Service, Washington, will analyze the clinical and statistical studies made in certain dusty trades and Prof. Theodore Hatch of the Harvard School of Public Health, Boston, will explain the methods of dust control.

Prof. Philip Drinker, also of Harvard, will outline ways of protecting the worker from the evils of this particular hazard.

Also of interest, from a different angle, will be an exhibit by Dr. David J. Price of the U. S. Department of Agriculture. He has arranged details so that a series of violent dust explosions will be shown.

The explosions, while violent, will be staged on a miniature scale at the Government Testing Station.

The explosions will take place in a miniature factory consisting of a room, a connecting gallery and a tower, with a total volume of 333 cu. ft. Explosions of representative commercial dusts, such as starch, sugar, cork, aluminum, wood, flour and similar particles, will be produced.

Safety Congress Program

ANNOUNCEMENT of the program of the 21st annual Safety Congress and Exposition to be held in Washington, D. C., October 3-7, has been made.

The meeting of the Cement Section opens Tuesday morning, October 4, with the annual report, presented by W. L. White, Jr., Medusa Portland Cement Co., general chairman, followed by a report of the nominating committee and election of officers. An analysis of accidents in the cement industry will then be given by A. J. R. Curtis, Portland Cement Association, followed by a discussion. Papers to be presented on the morning program are "Safety from the Executive Standpoint" (speaker to be announced later) and "In the Wake of the News," by Jack Dempster, Canada Cement Co., Ltd.

The afternoon session will include papers on "Building Safety and Facility into the Highway," by Maxwell H. Halsey, National Bureau of Casualty and Safety Underwriters; "Mental Hygiene of Accidents"; "How Can We Maintain Our Safety Record?" (speakers to be announced); and a symposium, "The Portland Cement Association's Safe Drivers League—Methods of Reducing Highway Accidents," by W. W. Hamilton, Alpha Portland Cement Co., and A. R. Couchman, North American Cement Corp. Each paper will be followed by discussion.

Papers to be read at the Wednesday morning session, which will be held jointly with the Quarry Section, will be "Safety in Limestone Mining and Quarrying," by C. A. Herbert, United States Bureau of Mines; "Safeguarding Our Eyes," by J. B. Zook, Great Lakes Portland Cement Co.; and "Industrial Health and Its Relation to Industrial Safety," by Dr. C. O. Sappington, National Safety Council. Each will be followed by a discussion. The morning program will be concluded by a movie, "Concrete for Safety," presented by A. R. Couchman.

On Wednesday afternoon a joint session will again be held with the Quarry Section, at which E. J. Mehren, Portland Cement Association, will deliver the address.

Quarry Section Program

The Quarry Section opens its program on Wednesday, the first day being the joint session with the Cement Section, the program for which is given above. On Thursday morning the meeting will be opened by John Prince, Stewart Sand and Material Co., general chairman. Papers will be presented on "Accident Prevention in the Nonmetallic Industries," "Economic Necessity for Community Safety Work and Its Relation to the Quarrying Industries," and "Analysis of Factors Affecting Compensation Insurance Rates in the Quarrying Industries," speakers for which will be announced later. Each paper will be followed by a discussion. Election of officers will also be held during the morning session.

A feature of the afternoon program will be talks on "The 1931 Safety Contest and What We Achieved Through Participation," by winners of the sand and gravel industry's contest and of the crushed stone industry's contest. A discussion will follow this. An illustrated paper will then be presented on "Visualizing the Mineral and Allied Industries," by M. F. Leopold of the Bureau of Mines. The program will be concluded with a round table discussion.

Portland Cement Production, August

THE PORTLAND CEMENT INDUSTRY in August, 1932, produced 7,835,000 bbl., shipped 10,968,000 bbl. from the mills and had in stock at the end of the month 19,379,000 bbl. Production of portland cement in August, 1932, showed a decrease of 42.2% and shipments a decrease of 27.7% as compared with August, 1931. Portland cement stocks at mills were 20.3% lower than a year ago. The statistics here given are compiled from reports for August, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

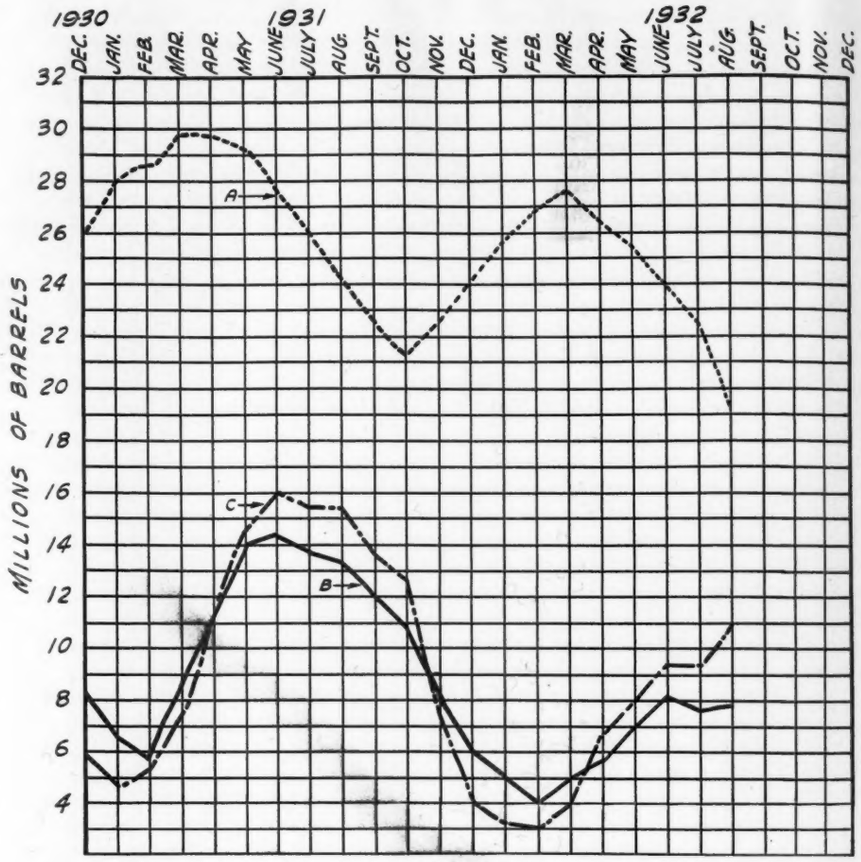
In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants both at the close of August, 1932, and of August, 1931.

RATIO (PER CENT.) OF PRODUCTION TO CAPACITY

	August		July	June	May
	1931 Pct.	1932 Pct.	1932 Pct.	1932 Pct.	1932 Pct.
The month	60.2	34.2	33.4	35.7	30.2
12 months ended	52.0	32.1	34.2	36.5	38.9

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during June and July, 1931 and 1932, in barrels:


1930
1931
1932
DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
MILLIONS OF BARRELS
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4
A
B
C

(A) Stocks of finished portland cement of factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN JUNE AND JULY, 1931 AND 1932, IN BARRELS*

Shipped to	1931—June	1932	1931—July	1932
Alabama	138,369	30,451	†90,757	26,937
Alaska	1,100	2,689	2,716	2,442
Arizona	41,110	16,050	†41,979	13,945
Arkansas	177,846	18,623	124,724	20,423
California	646,220	461,266	540,476	366,727
Colorado	99,511	66,933	73,107	45,274
Connecticut	166,357	91,086	166,381	80,902
Delaware	51,926	34,906	42,710	38,443
District of Columbia	141,277	88,395	126,637	87,905
Florida	95,649	36,600	†106,826	37,770
Georgia	183,317	100,778	†144,400	98,189
Hawaii	22,996	23,787	23,770	16,045
Idaho	25,547	10,241	22,930	8,961
Illinois	1,069,134	815,496	1,054,935	923,612
Indiana	616,508	410,735	682,234	482,652
Iowa	779,351	257,084	681,197	350,388
Kansas	300,175	159,469	198,757	88,175
Kentucky	215,082	87,771	†202,923	117,036
Louisiana	422,388	129,428	†505,614	97,884
Maine	90,276	84,934	86,427	80,949
Maryland	230,317	148,637	186,573	175,526
Massachusetts	318,456	253,183	377,774	272,853
Michigan	842,129	488,650	908,045	400,128
Minnesota	625,439	588,156	681,655	597,902
Mississippi	82,243	21,757	†66,519	15,598
Missouri	500,949	456,782	†439,866	478,055
Montana	35,590	14,670	32,722	15,319
Nebraska	272,654	86,063	281,405	48,233
Nevada	11,041	74,982	9,774	99,152
New Hampshire	43,410	21,685	63,680	17,092
New Jersey	508,242	310,576	519,732	282,170
New Mexico	29,840	16,937	21,853	11,869
New York	2,498,158	1,287,121	2,415,239	1,246,668
North Carolina	163,922	30,921	126,608	28,314
North Dakota	55,251	24,936	31,587	22,693
Ohio	817,720	525,399	869,396	539,371
Oklahoma	290,304	105,703	226,890	65,442
Oregon	109,997	40,056	102,903	56,746
Pennsylvania	866,697	461,699	807,513	451,127
Porto Rico	17,385	4,350	5,595	2,337
Rhode Island	66,438	36,789	57,157	33,395
South Carolina	224,825	50,320	†151,919	24,879
South Dakota	110,088	28,654	101,420	27,280
Tennessee	162,661	88,321	†110,542	90,884
Texas	586,255	333,082	588,163	331,951
Utah	43,516	9,655	42,650	10,745
Vermont	42,905	38,453	48,958	55,515
Virginia	193,085	82,323	178,952	72,801
Washington	226,264	167,838	265,116	119,136
West Virginia	184,176	101,063	179,975	89,286
Wisconsin	569,655	394,935	611,166	483,432
Wyoming	19,781	10,467	20,863	7,177
Unspecified	1,246	11,394	†61,210	41,079
	16,034,778	9,242,279	15,512,920	9,198,814
Foreign countries	42,222	21,721	32,080	16,186
Total shipped from cement plants	16,077,000	9,264,000	15,545,000	9,215,000

*Includes estimated distribution of shipments from three plants for June and July, 1931, and for July, 1932; from four plants for June, 1932. †Revised.

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1931 AND 1932, IN BARRELS

Month	1931—Production	1932	Stocks at end of month 1931	1932
January	8,129,000	6,107,000	10,384,000	8,184,000
February	7,473,000	5,176,000	11,946,000	9,375,000
March	9,586,000	5,443,000	13,318,000	10,025,000
April	11,540,000	5,924,000	13,854,000	10,511,000
May	13,159,000	6,273,000	13,087,000	9,922,000
June	12,679,000	6,803,000	11,837,000	8,877,000
July	12,246,000	6,613,000	10,209,000	*7,889,000
August	11,664,000	7,078,000	8,468,000	7,202,000
September	10,414,000	.....	6,918,000	.....
October	9,825,000	.....	6,021,000	.....
November	8,259,000	.....	6,215,000	.....
December	6,840,000	.....	7,035,000	.....

*Revised.

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN AUGUST 1931 AND 1932, AND STOCKS IN JULY, 1932 (IN BARRELS)

District	Production 1931—August—1932		Shipments 1931—August—1932		Stocks at end of month 1931	1932	Stocks at end of July, 1932*
Eastern Penn., N. J. & Md.	2,891,000	1,508,000	3,147,000	2,093,000	5,769,000	3,979,000	4,564,000
New York and Maine	1,375,000	879,000	1,556,000	932,000	1,489,000	1,594,000	1,647,000
Ohio, West'n Penn., W. Va.	1,296,000	650,000	1,353,000	1,062,000	3,505,000	2,293,000	2,705,000
Michigan	832,000	378,000	1,065,000	786,000	1,975,000	1,599,000	2,007,000
Wis., Ill., Ind. and Ky.	1,818,000	1,211,000	2,316,000	2,018,000	3,020,000	1,942,000	2,750,000
Va., Tenn., Ala., Ga., Fla., La.	1,193,000	379,000	1,082,000	604,000	1,687,000	1,434,000	1,659,000
East'n Mo., Ia., Minn., S.D.	1,449,000	985,000	1,737,000	1,530,000	2,474,000	2,377,000	2,922,000
West'n Mo., Nebraska, Kansas, Oklahoma and Arkansas	987,000	645,000	1,121,000	661,000	1,490,000	1,531,000	1,547,000
Texas	644,000	325,000	667,000	386,000	603,000	605,000	667,000
Colo., Mont., Utah., Wyo., Ida.	209,000	206,000	232,000	141,000	585,000	482,000	417,000
California	552,000	513,000	595,000	549,000	1,114,000	1,014,000	1,049,000
Oregon and Washington	303,000	156,000	301,000	206,000	602,000	529,000	578,000
	13,549,000	7,835,000	15,172,000	10,968,000	24,313,000	19,379,000	22,512,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1931 AND 1932 (IN BARRELS)

Month	1931—Production—1932		1931—Shipments—1932		Stocks at end of month 1931	1932
January	6,595,000	5,026,000	4,692,000	3,393,000	27,759,000	25,778,000
February	5,920,000	3,971,000	5,074,000	3,118,000	28,612,000	26,657,000
March	8,245,000	4,847,000	7,192,000	3,973,000	29,676,000	27,545,000
April	11,245,000	5,478,000	11,184,000	6,536,000	29,715,000	26,496,000
May	14,010,000	6,913,000	14,200,000	8,020,000	29,554,000	25,394,000
June	14,118,000	7,921,000	16,077,000	9,264,000	27,602,000	24,035,000
July	13,899,000	7,659,000	15,545,000	9,215,000	25,934,000	*22,512,000
August	13,549,000	7,835,000	15,172,000	10,968,000	24,313,000	19,379,000
September	12,092,000	.....	13,671,000	.....	22,736,000	.....
October	10,762,000	.....	12,360,000	.....	21,218,000	.....
November	8,161,000	.....	7,156,000	.....	22,219,000	.....
December	5,974,000	.....	4,142,000	.....	24,098,000	.....
*Revised.	124,570,000	.....	126,465,000	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN AUGUST, 1931 AND 1932 (IN BARRELS)

District	1931—Production—1932		Stocks at end of month 1931	1932
Eastern Pennsylvania, New Jersey and Maryland	2,514,000	1,346,000	1,237,000	976,000
New York and Maine	1,019,000	725,000	600,000	455,000
Ohio, Western Pennsylvania and West Virginia	1,123,000	503,000	1,100,000	677,000
Michigan	587,000	315,000	823,000	1,012,000
Wisconsin, Illinois, Indiana and Kentucky	1,479,000	949,000	871,000	489,000
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	1,218,000	381,000	715,000	436,000
Eastern Missouri, Iowa, Minnesota and South Dakota	1,302,000	938,000	587,000	478,000
Western Missouri, Nebraska, Kansas, Oklahoma, Arkansas	817,000	552,000	461,000	499,000
Texas	633,000	303,000	310,000	238,000
Colorado, Montana, Utah, Wyoming and Idaho	181,000	281,000	258,000	294,000
California	503,000	550,000	1,252,000	1,349,000
Oregon and Washington	288,000	235,000	254,000	299,000
	11,664,000	7,078,000	8,468,000	7,202,000

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1931 AND 1932

Month	1931—Exports—1932 Barrels	Value	Barrels	Value	1931—Imports‡—1932 Barrels	Value	Barrels	Value
January	41,199	$ 115,678	36,704	$ 82,984	95,609	$ 120,298	14,375	$ 16,648
February	25,703	88,989	12,889	39,350	21,984	25,391	83,706	69,197
March	54,599	144,579	39,105	81,856	70,378	80,360	19,173	17,215
April	40,478	116,564	30,123	69,451	53,333	58,576	59,392	41,487
May	48,028	140,953	31,634	71,048	19,325	20,568	9,223	7,358
June	43,597	107,610	33,134	72,084	32,079	42,955	20,963	15,496
July	29,344	97,837	18,872	54,814	14,332	15,582	31,518	24,904
August	39,517	106,643	.....	.....	8,895	11,739	.....	.....
September	27,570	81,399	.....	.....	33,574	33,520	.....	.....
October	24,531	68,524	.....	.....	39,642	42,380	.....	.....
November	33,200	97,796	.....	.....	27,940	22,235	.....	.....
December	21,887	54,028	.....	.....	40,147	34,314	.....	.....
	429,653	$1,220,600	.....	.....	457,238	$ 507,918	.....	.....

Exports* and Imports†

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN JULY, 1932

Exported to	Barrels	Value
Canada	1,125	$ 4,228
Central America	3,351	6,596
Cuba	300	1,396
Other West Indies	430	1,088
Mexico	4,614	12,613
South America	8,088	23,236
Other countries	964	5,657
	18,872	$54,814

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN JULY, 1932

Imported from	District into which imported	Barrels	Value
Belgium	Porto Rico	4,528	$2,867
	San Francisco	10,061	9,361
	Total	14,589	$12,228
Canada	Maine and N. H.	66	$198
Denmark	Porto Rico	12,916	9,870
Germany	Los Angeles	299	432
Japan	Hawaii	3,548	2,079
United K gd'm.	New York	100	97
	Grand total	31,518	$24,904

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO, IN JULY, 1932

	Barrels	Value
Alaska	2,998	$ 6,644
Hawaii	22,358	47,637
Porto Rico	2,338	2,964
	27,694	$57,245

*The value of exports of domestic cement is the actual cost at the time of exportation in the ports of the United States whence they are exported, as declared by the shippers on the export declarations.

†The value of imported cement represents the foreign market value at the time of exportation to the United States.

‡Includes hydraulic cement clinker, and white nonstaining portland cement.

Japan Cuts Cement Production by 57½%

ALTHOUGH many commodities are doing better, Japanese business is not taking the present opportunity to embark on new construction, and cement demand has been falling gradually. For three months from September 1, the cement makers of Japan will curtail production by 57½% of capacity. The previous ratio was 56%.

The leading companies are endeavoring to obtain better control of the export business, with the idea of doing away with competitive price slashing. Accordingly, they have taken advantage of the guild law to form an association for the exploitation of foreign markets. The new guild is not likely to be fully effective, for two reasons, but it is a start toward complete control of the market. The first of the reasons is that Onoda Cement, second largest of the companies in the empire, refuses to join. The second reason is that Manchuria, the East Indies and China, the three best markets, are excluded from the territory to be controlled.

Onoda is a member of the Japan Cement Association, but four other small companies do not belong. Strenuous efforts are being made to bring these five concerns into line with the nine participants, and to establish export ratios on the basis of the averages for the past three years. Later it is hoped to include Manchuria, China and the East Indies into the territory covered by the guild. —*Wall Street Journal* (New York City).

Irish Tariff Hurts England's Cement Trade

THE RECENT DUTY of 20% ad valorem imposed by the Irish Free State on British cement will probably result in the loss by Great Britain of a major portion of its sizable trade with that country, according to the Commerce Department's Minerals Division.

All of the Free State's cement is imported, and for a number of years about 60% has come from Great Britain. In 1931 the total imported was 1,349,332 bbl.

The new duty, which is applied only against Great Britain, should open the door to other countries, particularly, it is thought, to Belgium. Great Britain's domination of this market in the past has been attributed to superior quality of its cement, to the action of British producers in lowering their prices to the Continental level, and to the establishment of active agencies in Irish ports.

Fertilizer Merger Abandoned

NEGOTIATIONS for the merger of Virginia Carolina Chemical Corp. and the Armour Fertilizer Works have been ended by a victory for the minority group of stockholders who opposed the consolidation.

Officers of Virginia Carolina have issued a statement that Armour has been notified that the Virginia Carolina directors at an adjourned meeting scheduled for September 23 would advise that a special meeting of stockholders called to consider the matter be adjourned sine die. An indefinite postponement of the stockholders meeting will automatically result in the dropping of all negotiations.—*Wall St. Journal* (New York).

Estimates New Building and Modernization for 1933

THE *American Architect* has completed a survey of architects from which it has made a forecast of the new building and modernization projects to be constructed from September, 1932, to September, 1933. This survey and forecast has been prepared for manufacturers and distributors of the building field, and for advertising agencies as a basis for sales quotas and sales cost budgets.

It is estimated that a total of $572,738,000 in work is now (August 15) in the planning stage and that $1,181,068,000 of contemplated construction may be expected within the year ending September, 1933. The forecast has been published, giving data on new building under planning, contemplated new building, modernization under planning, contemplated modernization and a forecast of total construction, by state. This forecast was based upon information submitted by 1636 architects, and the information is tabulated as submitted. The number and type of projects reported is given in a series of tables, so that volume for every major type in each state may be seen.

An interesting point in the estimate by architects is that the 1636 architects have 2935 projects under planning, less than an average of two each, of which 1145 are homes to cost less than $20,000. They report 7514 prospective building projects, of which 3429 are homes to cost less than $20,000. The total value of new building projects under planning by these architects as reported is $299,623,082, while the estimated total for the country is $478,800,000. Prospective building reported by the architects is $890,142,922, with a total of $1,047,200,000 forecast for the entire country. From this it would seem the forecast was conservative. The forecast omits all Federal and other publicly financed work except that apparently to be given out to private architects.

Defends Buying of Sand by Town Owning Pits

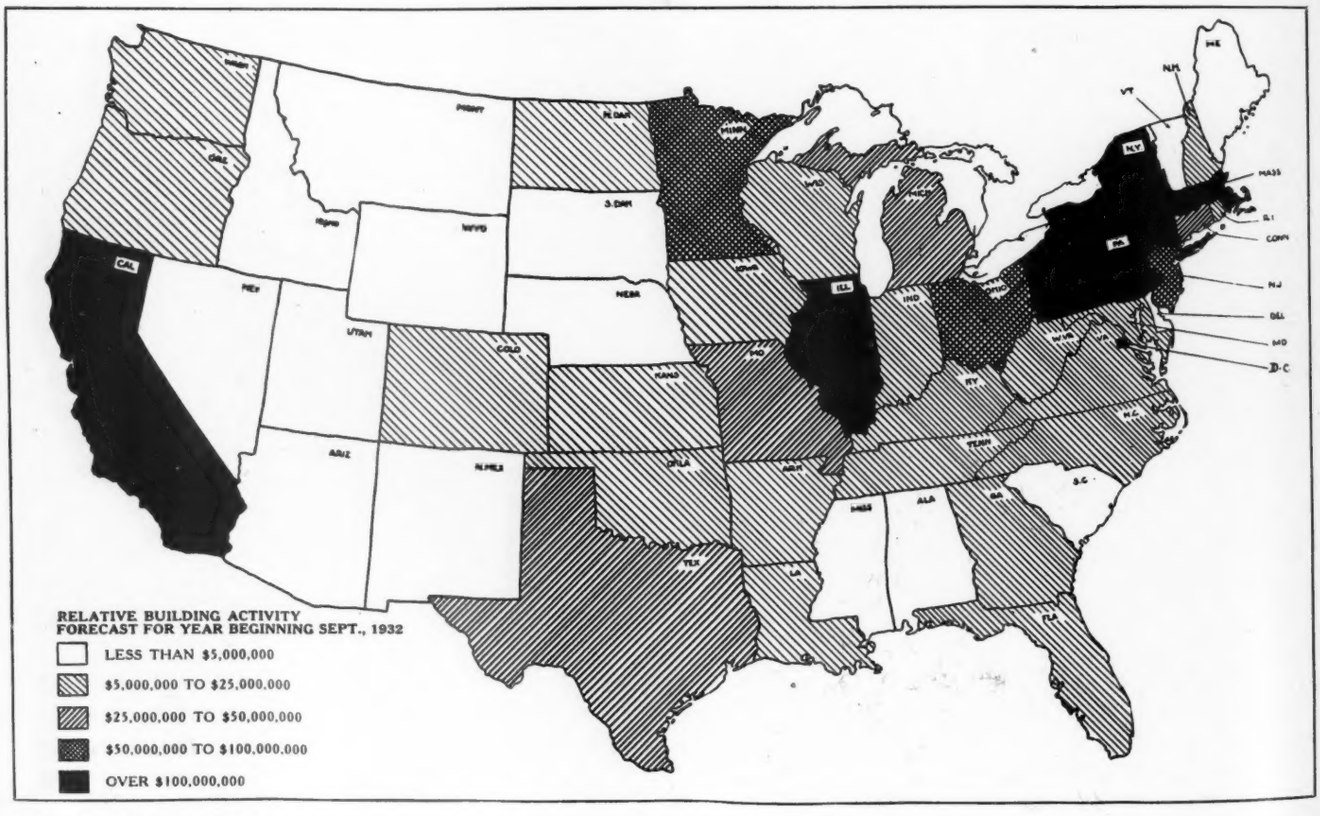
JOHN H. CAREY, of East Islip, N. Y., recently appeared before the Islip Town Board to request information why, when the town owned six sand pits in different villages, it was necessary to spend large sums for screened sands for sanding oiled roads.

William Collins, town superintendent of highways, answered Mr. Carey with an extensive report on highway expenditures by which he showed that road work had cost the town less this year than last. He produced expert opinion to prove it was cheaper for the town to buy screened sand for road use at 35c. a cu. yd. than to install expensive screening equipment in the town-owned pits. Screened sand, he added, is the best for road purposes, because it eliminates the necessity of having to remove stones and gravel when rough sand is used.—*New York* (N. Y.) *Times.*

Expanded Construction of Waterworks Seen

EXTENSION of the water supply facilities of municipalities of the United States will be pushed forward at a rapid rate when easier money conditions prevail, according to Swart, Brent and Co., Inc., New York City, specialists in waterworks securities. Pointing out that the demand for water outstrips the normal increase in population, with past experience showing that the per capita consumption of water in this country increases from 15 to 20 gal. daily each decade, the statement of the investment house asserts that many cities and towns in this country must soon reach out for new sources of water supply to meet the mounting needs of growing populations.

Fields reports received by Swart, Brent and Co. disclose that many cities are making preliminary surveys for permanent waterworks improvements aggregating several hundred million dollars and that active work will be inaugurated when financing conditions become more favorable. Until a few years ago waterworks improvements in this country totaled around $50,000,000 annually, but it is expected that construction projects may amount to double this amount annually during the next few years. Many cities and towns are supplied with water by private companies, and similar expansion of facilities are planned by them as with the municipally owned systems.—*The Constructor* of the Associated General Contractors.



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Estimated building activity in the United States for the year beginning September, 1932

More Federal-Aid Roads Now Under Construction

AN INCREASE on nearly 300 miles in the total of Federal-aid roads under construction August 31, as compared with July 31, and gains in the estimated total cost of projects under construction and of projects approved but on which work has not yet started were reported September 19 by the Bureau of Public Roads, Department of Agriculture, in a tabulation of the status of Federal-aid road work.

The following additional information was provided:

The estimated cost of projects under construction August 31 was $242,175,216, compared with $240,856,973 July 31. The increase in cost of projects approved, but not yet started, was still larger, the figures for August 31 and July 31, respectively, being $56,154,483 and $49,676,392.

More than 300 miles of Federal-aid road projects were completed during August, the total completed advancing from 101,191.2 miles to 101,504.8. The projects under construction were stated to be 96% completed.

The amount of Federal-aid road funds remaining available for new projects was reduced during the month from $56,835,958 to $51,425,482.

A New Product of Silica

SILICA BLACK, a new product developed in the laboratories of West Virginia University, was explained at a meeting of the American Chemical Society in Denver, Colo., recently by Dr. C. A. Jacobson of the faculty. A variety of uses to which the product may be put commercially has already been discovered.

Dr. Jacobson said a paint firm in Philadelphia has tested the product and found it superior in many respects to pigments now in use. The product may also be developed for use in the reduction of ores at high temperatures and as a carrier of insecticides.

Silica black, as discovered by Dr. Jacobson, is made by reducing coal to an extremely fine powder and mixing it with some form of silica which has been pulverized.—*Morgantown* (W. Va.) *Post.*

Sands, Clays and Minerals

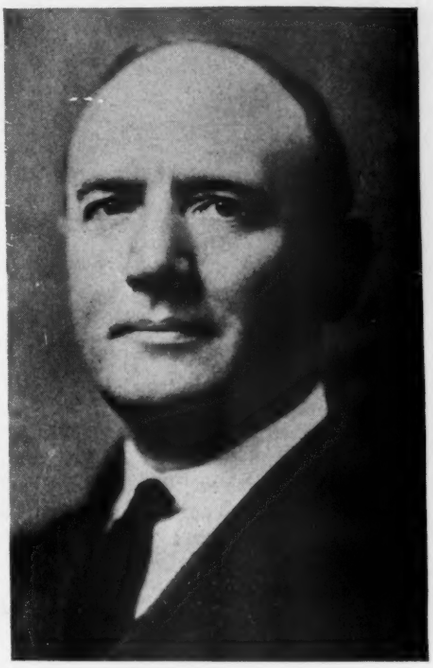
A NEW quarterly magazine, *Sands, Clays and Minerals,* is announced by Algernon Lewin Curtis, Chatteris, England. Objectives of the magazine are given as seeking to help British trade by promoting closer cooperation between the several interested industries; to give practical and reliable knowledge on sands, clays, etc., to manufacturers and other business men into whose industries these materials go; and to interest all those who are in any way concerned with the minerals which the earth's crust provides for the thousand-fold use of mankind.

Frederick W. Kelley

FREDERICK WILLIAMS KELLEY, one of the best known figures in the American portland cement industry, whose acquaintance was extensive throughout the cement industry of Europe, passed away on September 19 at his summer home at Altamont, N. Y.

Mr. Kelley had been president of the North American Cement Corp., Albany, N. Y., since its organization about ten years ago and prior to that time had been president of the Helderburg Cement Co. of Albany, one of the organizations which was merged with others in the North American Cement Corp.

For almost a third of a century Mr. Kelley has been widely known in the field of



technical thought throughout a wide range of subjects, including cement manufacture, cement mill design and operation, and technical developments of concrete along many different lines.

Throughout his long connection with the cement industry he rendered a service that was unceasing and unselfish. As much of his activity was along lines of common interest to all manufacturers, he gave freely of his ability as an executive and a technologist. He became known throughout the industry as a warm-hearted friend, ever ready to help.

Mr. Kelley was born at Albany, December 15, 1870, and graduated in mechanical engineering at Cornell University in 1893. He became associated with the Helderburg Cement Co. in 1900, two years after its organization, and was in charge of the erection and development of the company's plant at Howe's Cave, N. Y. This plant was erected after two years' operation of a small experimental plant erected by the company. Mr. Kelley was credited with having introduced several innovations in cement-plant machinery and it is believed that his introduction of synchronous motors at the Howe's Cave plant was the pioneer installation of this kind for cement mill use.

The Helderburg company participated in the organization of the Association of the American Portland Cement Manufacturers in 1902, and 10 years later on the death of T. Henry Dumary, Mr. Kelley became the head of that company.

Mr. Kelley was ever active in the Portland Cement Association committee work, being chairman of the committee on technical problems, and its predecessor, the committee on association laboratory and technical research, from 1913 to 1922. He was elected to the executive committee in 1914 and became first vice-president in 1915. He was treasurer of the Portland Cement Association in 1919, 1920 and 1921 and was elected president in 1922 and again in 1923. He served on the board of directors until 1928.

During Mr. Kelley's term as president of the Portland Cement Association the centennial of portland cement was celebrated and Mr. Kelley was head of the group of prominent men of the cement industry who journeyed to Leeds, England, where they placed the tablet in memory of Joseph Aspdin, the inventor of portland cement, in the town hall of his home city of Leeds.

In addition to his cement interests, Mr. Kelley was vice-president and a director of the National Commercial Bank and Trust Co. of Albany, treasurer of the City Savings Bank of Albany and a director of the Consolidated Car Heating Co. He was president of the Albany Chamber of Commerce in 1921-1922, president of the Albany hospital and other local institutions and was a member of a number of leading clubs of Albany and New York City.

Although confined to his home by illness extending over the past three years, Mr. Kelley's interests in the affairs of the cement industry was maintained until the last. Mr. Kelley suffered a stroke three years ago and never was able thereafter to walk. He had transacted most of his business since his illness from a wheel chair. His board of directors held a meeting at his summer home on Friday, the week before his death.

Nonmetallic Minerals in Canada

INFORMATION on the production of actinolite, barytes, bituminous sands, fluorspar, graphite, magnesite, phosphate, silica brick, sodium carbonate, sodium sulphate, sulphur, etc., in Canada in 1931 has been published by the Dominion Bureau of Statistics. A brief review of the use of each mineral is given in the report.

Portable Units for Temporary Sand and Gravel Plants

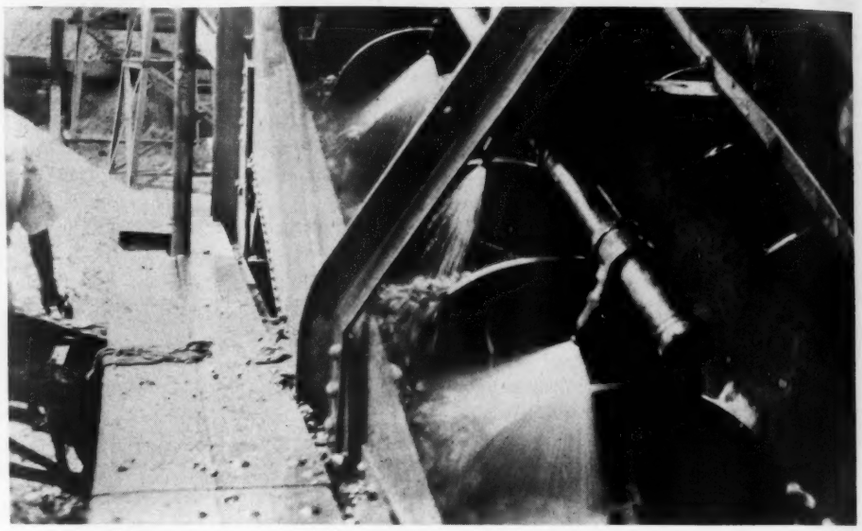
WITH PRESENT LOW PRICES and relatively high freight rates for aggregates, portable and temporary plants of one kind or another are being used to produce much material that under previous conditions, and in former times, came from commercial plants. This is particularly true of highway jobs, which, broadly speaking, are becoming constantly farther removed from built-up localities where commercial plants are generally located.

Up to this time such portable and temporary aggregate producing plants have been operated by road contractors, highway authorities, or in a few instances by producers who specialized in this kind of operation. In very few cases, so far as known, have established commercial producers attempted to supplement their fixed operations with these portable or temporary ones. Why shouldn't they?

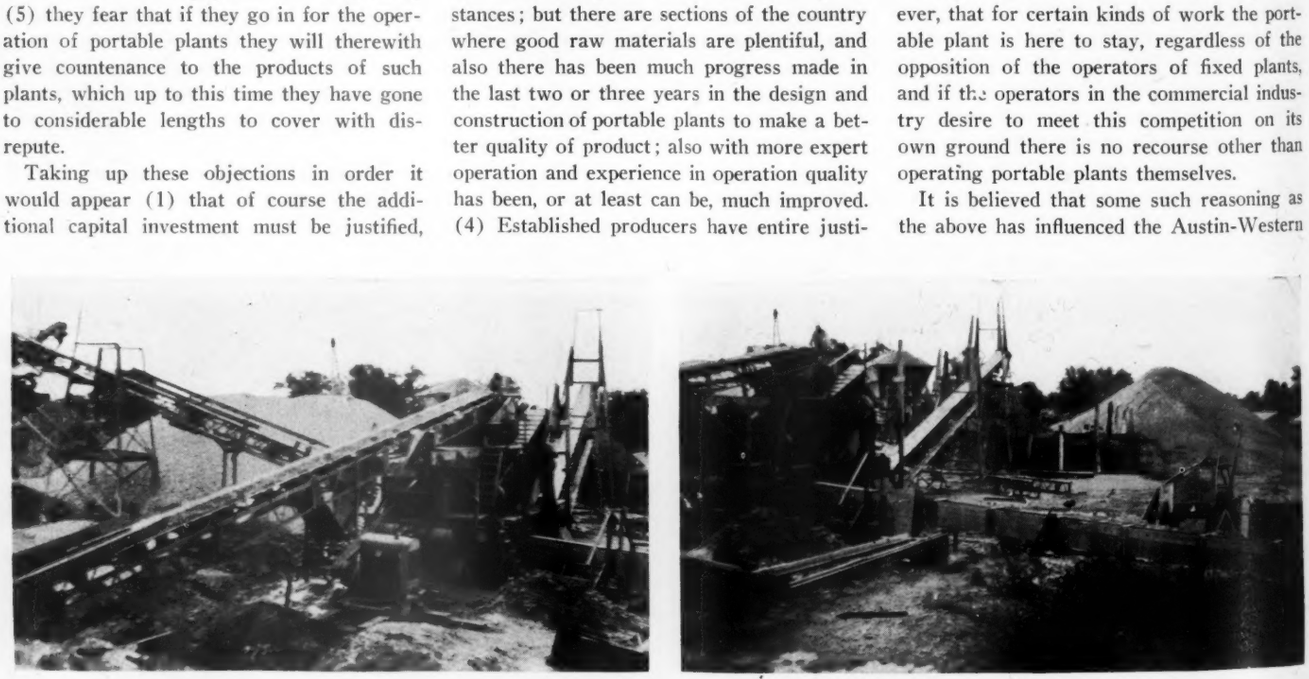
The answer seems to be: (1) They naturally hesitate to make further capital investment to compete with the investment they already have in fixed plants; (2) they are skeptical of the possibilities of profit; (3) they are skeptical of the quality of the material it is possible to produce; (4) they are prejudiced against portable plants because of the character of the advertising manufacturers of equipment have used to promote their use by contractors, county highway authorities, etc., and because of the flimsy character of much of the equipment so advertised; (5) they fear that if they go in for the operation of portable plants they will therewith give countenance to the products of such plants, which up to this time they have gone to considerable lengths to cover with disrepute.

Taking up these objections in order it would appear (1) that of course the additional capital investment must be justified, as it would be if the producer is faced with the certainty of losing a large share of his market unless he protects it in this manner. (2) As to the possibilities of profit from a legitimate portable-plant operation we doubt if established producers have any data to judge from; we think they are influenced far more by prejudice and opinion than by operating data or experience. (3) The prejudice against the quality of the material produced was undoubtedly well founded in many instances; but there are sections of the country where good raw materials are plentiful, and also there has been much progress made in the last two or three years in the design and construction of portable plants to make a better quality of product; also with more expert operation and experience in operation quality has been, or at least can be, much improved. (4) Established producers have entire justification for the prejudices based on the manner in which some manufacturers of portable plants have advertised them to the construction industry. Because of this ROCK PRODUCTS, for example, has consistently refused to accept the advertising of these manufacturers. (5) The subject covered in this objection—the fear of giving countenance to the product of portable plants—is a big subject of concrete aggregates economy, too big to discuss here. It is believed, however, that for certain kinds of work the portable plant is here to stay, regardless of the opposition of the operators of fixed plants, and if the operators in the commercial industry desire to meet this competition on its own ground there is no recourse other than operating portable plants themselves.

It is believed that some such reasoning as the above has influenced the Austin-Western



Closeup of screws and sprays in unit shown below



Two views of portable sand and gravel washing unit at a Texas operation

Portable sand and gravel washing unit

Road Machinery Co. to develop the unit described and illustrated in what follows. This company has served the established producer for many years and it now believes it has developed a unit that will help this producer supplement his fixed operations.

This gravel or stone washing and screening unit comprises in a comparatively small compass three large sized revolving screw type washers, a triple-deck gyrating screen, a 20-ft. long feeding conveyor, receiving hopper, the power plant, all of the piping and valves necessary for its operation. It rejects to one side all material of a certain specified size and divides the remainder into three sizes, delivering the washed stone and sand to separate conveyors, which in turn deposit it into stock piles or bins.

The feeding conveyor and the delivery conveyors all have their own power and are mounted on trucks, so that they can be quickly moved when necessary.

If the character of the gravel being washed is such that crushing is necessary, a separate crushing unit on trucks, with its own power, can be set alongside the washing plant, which will take the oversize, break it down to whatever size may be desired, and return it to the plant to go through with the other material.

The plant above described is claimed to be built to endure under the most adverse operating conditions and is made to specifications that imply most modern engineering practice. Anti-friction bearings are used throughout and adequate protection to all wearing surfaces is provided.

The building of a portable washing plant has been even a more serious problem for the equipment manufacturer than the crushing and screening plant, because of the different problems involved and the need for room in which to complete the washing and separating operations. But these obstacles have been overcome, the manufacturer of this unit states, and there are now on the market portable washing plants that combine in a very limited space the ability to separate and wash thoroughly clean, large quantities of gravel, separating the finished product into various sizes and depositing them in stock piles, bins, etc., as desired by the user. When one visualizes the amount of equipment that is sometimes used in a stationary plant for the production of 600 or 700 cu. yd. of washed material per day, it is hard to realize that there is now available a portable unit weighing less than 30,000 lb., that will accept, classify and wash up to 1000 tons per day of 10 hours, according to the claims of the manufacturer, and that this whole unit is mounted on one set of trucks and can be quickly installed in any roadside pit.

An example of the use of this unit is a plant in the South to produce all of the aggregate required for a 29-mile stretch of 20-ft. pavement, of which there is at this time about five miles completed. So far the plant has been operating quite satisfactorily, but due to a local condition the output has been slowed down considerably. At the start of operation the plant averaged about 100 cu. yd. per hour, but as the pit is becoming larger this figure has been somewhat reduced (due to a wide bed of quicksand).

This plant, as shown in the illustrations, requires three inclined screws operating in a water-tight tank over which is a three-deck 4-ft. by 8-ft. gyrating screen. The screen is fed by a suitable belt conveyor from the pit, which delivers the gravel into a sluice box. From this box material is washed to the screen, where it is sprayed and graded. One of the screws is for sand and the other two are for two sizes of gravel. After sizing, the gravel and sand flow by gravity to the different screws which dewater the sand, also scrub and scour the gravel. The screws deliver the material at the upper end, where it is spouted to one of three conveyors leading to a stock pile.

On this project four different specifications of material are allowed, but the specification being used calls for minus ¼-in. sand and minus 3-in. plus ¼-in. for coarse aggregate, with stated percentages of various sizes between these limits. There are, therefore, but two stock piles at this job. The oversize is such a small percentage that it is more economical to waste than to install a crusher. When producing gravel at the rate of 75 cu. yd. per hour it is necessary to use about 800 gal. of water per min. The water is supplied to the plant at a pressure of about 15 lb. per sq. in. by a 6-in. centrifugal two-stage pump directly connected to a 90-hp. gasoline engine. Both pump and engine are mounted on a truck so as to be readily moved to a new location.

What Will Commercial Industy Do?

Can and will the commercial sand and gravel industry make use of such equipment, or will it be content to see more and more isolated highway jobs let to contractors who will use such plants to produce their own aggregates? Rock Products is entirely open-minded on the subject, and it feels sure the equipment manufacturer will welcome suggestions or criticisms from the established producers of aggregates as to the feasibility of supplementing the output of their fixed plants by the operation of such units. We are confronted by conditions and not theories, and live-wire producers must have some thoughts on the subject.

In all probability, with a return to a greater volume of general building and construction, which of necessity will be in the more thickly settled parts of the country, the established plants will come to their own again. But some highway construction will continue to be carried on in localities more or less remote from established plants, and such construction will furnish too temporary a market for a new fixed plant. The question is, do you commercial producers want this business enough to make an honest-to-goodness effort to go after it? If you do, it would seem the operation of portable plants is the only answer.

Pegmatite Deposits of Virginia

A REPORT which discusses chiefly the mica and feldspar deposits of economic importance in the Piedmont, Va., region has been issued as Bulletin 33 by the Virginia Geological Survey.

New Machinery and Equipment

New Cooler for Cement Clinker

A NEW type of cooler which consists of a reciprocrating grate has been developed by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The grate on which the clinker is carried consists of ¼-in. round bars with ¼-in. openings between them and air is blown up through these openings and through the clinker.

A windbox is attached below the grate and reciprocates with it. Any clinker which sifts through the gate is carried forward on the bottom of the windbox. The grate and windbox are reciprocated at the rate of 200 to 300 times per minute and as a result the clinker is carried forward evenly with constant agitation.

It is stated that this cooler has a large capacity and that the clinker can easily be cooled to a temperature not more than 20 deg. above the outside air.

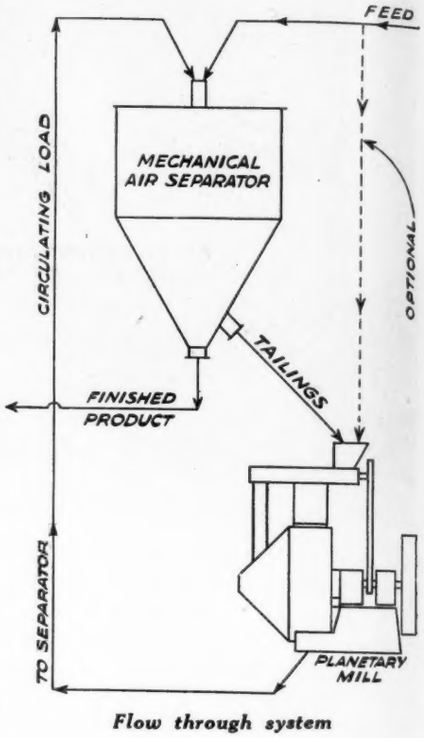
It is stated that it does not resemble the Lee or Lepol coolers except in that it has a grate.

Planetary Mill

A PLANETARY MILL for closed circuit operation with mechanical air separator is announced by the Raymond Bros. Impact Pulverizer Co., Chicago, Ill. It is particularly adapted to pulverizing limestone, gypsum and similar nonmetallic minerals preparatory to classification, the manufacturer states.

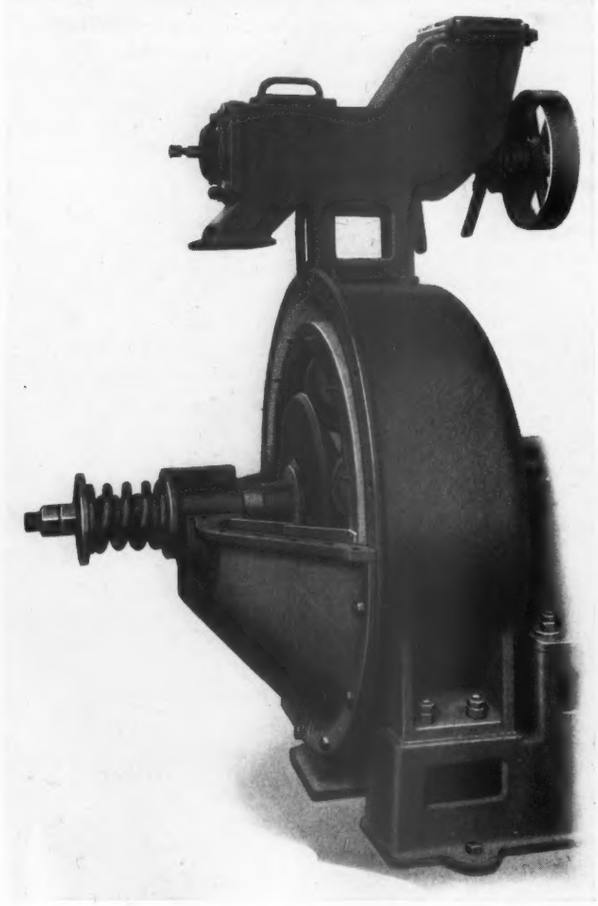
In operation the mill handles the raw material direct from the crusher and reduces it in one operation to the fineness required for the separator feed. Where the product contains a mixture of fine material it is first passed through the separator and the tailings are discharged to the mill for regrinding. If the product is too course it is fed direct to the mill for preliminary pulverizing, then elevated to the separator for classifying, while the tailings are returned to the mill as before.

Advantages claimed for this unit are that it grinds to a medium degree of fineness, which is said to permit large milling capacity with low power cost, at the same time producing a high percentage of fines to maintain efficient separator operation; it is compact; it has relatively few parts; it has few oiling points; it has low maintenance, and the wearing elements are readily replaceable.

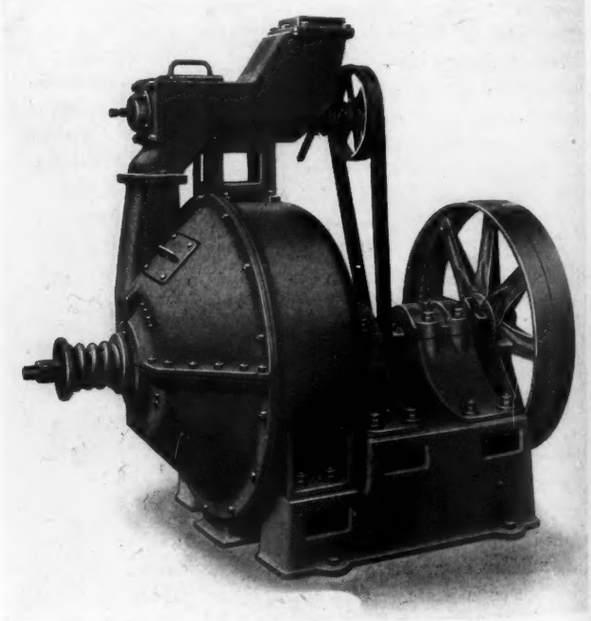


Flow through system

The planetary mill operates on the ball and ring principle, the grinding ring revolving in a vertical plane while six free rotating balls move in the circular orbit formed by the grooved grinding ring. The balls crush the material against the gringing ring by



Showing grinding ring and balls



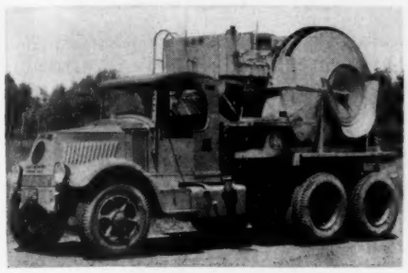
Mill completely assembled

centrifugal force. Rate of feed to the mill is regulated by a gate valve at the hopper. Grinding pressure is maintained by the centrifugal action of the balls as they whirl in the grinding ring, and it is held constant at any given speed of the mill. One base carries the mill, drive and feeder complete.

●

Uses Convertible Trucks

THE 11 Mack Model AK, six-cylinder, six-wheelers recently delivered to B. Perini and Sons, contractors, of Framingham, Mass., are versatile units—dump trucks one day, concrete mixers the next.



Mixing unit may be substituted for dump bodies

As earth movers they average 11 cu. yd. to the load. When concrete is ready to be poured, the dump bodies and hoists are removed and 5-yd. Jaeger mixers are mounted on the chassis. An accompanying illustration shows one of these trucks with the mixing unit mounted on it.

●

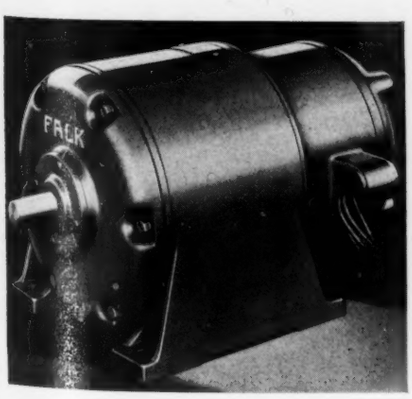
Motor Speed Reducer

THE Falk Corp., Milwaukee, Wis., announces three styles of "Motoreducers" (combined motor and speed reducer).

These Motoreducers are said to retain all the advantages of separate motors and speed reducers and, at the same time, give increased compactness, simplicity and economy.

The gear housing in every case acts as a support for the motor.

In the integral type the motor end bell is removed and the motor close coupled through a bayonet type of joint to the gear case. In the flexible type the round frame type of motor is used and the end bell retained. In the all-motor type any standard horizontal type motor may be used, the motor being connected through a Falk flexible coupling to the reducer housing.



Makes compact drive unit

All three types are supplied from ¾ to 75 hp., with ratios from 4.6 to 288. Non-planetary, helical type gears of special Falk make are used throughout. Bearings are oversize ball bearings in all but the larger sizes. Efficiency is a minimum of 97%, the manufacturer states.

●

Portable Plant in Units

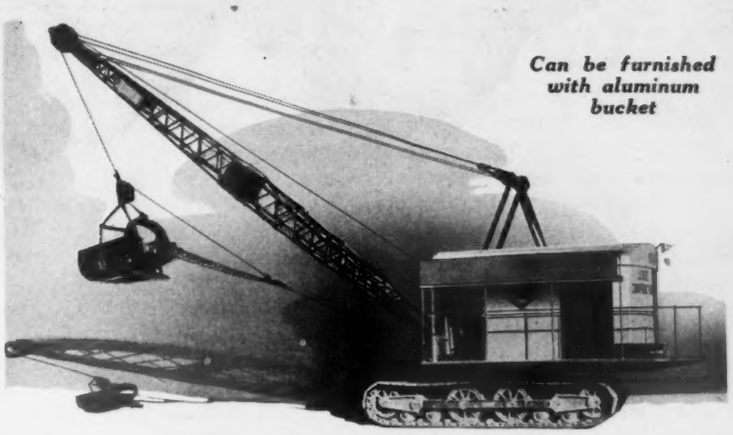
TO ADD to the flexibility of established plants and to improve their competitive position with roadside pit operators, the Stephens-Adamson Manufacturing Co., Aurora, Ill., announces a unit type plant for such work.

The plant consists of a number of standard units designed for quick assembly in different combinations to suit the particular job or deposit in which the operator is interested. These units consist of receiving hopper and feeder, crushing unit, screening unit, storage hoppers and complete belt conveyor units. Each unit is self-contained and comparatively light and easy to move.

The crushing unit is built to take one or two crushers of various makes, types and sizes. Likewise, the screening unit will mount a single, double or triple deck vibrator screen. Where washed material is required, water sprays are added above the vibrator screen and a classifier or dewatering unit is quickly inserted.

Gas or Diesel engines or electric motor drives can be furnished and where electric power is not available for motors, portable generator sets are furnished.

Several advantages are claimed for this type of plant. According to the manufacturer, the various units, while quite compact, permit greater headroom and clearance for inspection, lubrication and adjustment than is practicable in single assembly plants. The operator has a wide variety of combinations to choose from and does not have to haul any unnecessary equipment to new locations. Another economy claimed is that the operator can buy only the units actually required for the job on hand.



Can be furnished with aluminum bucket

Heavy Duty Dragline

THE Ohio Power Shovel Co., Lima, Ohio, announces the Lima type 601 heavy duty dragline. A feature of this dragline is that helical gears are used throughout, except the bevels. Other features of this new dragline are anti-friction bearings at all vital points, extra large diameter of drums, and of sufficient width to carry the maximum amount of cable without wrapping, independent clutches of the syncro-power type, crawlers designed for low bearing pressure and difficult traveling conditions, and that steering is accomplished from the cab with the rotating frame in any position.

It may be powered either with gasoline or Diesel engine of 120 hp., and is furnished in 1½ and 2 cu. yd. capacities. When desired, aluminum dragline bucket may be obtained having increased capacity and output.

●

Rubber Paint

A NEW LINE of rubber paints is announced by the B. F. Goodrich Rubber Co., Akron, Ohio.

These paints have as a base a commercial form of rubber isomer which is said to impart valuable properties not found in ordinary paint films and characterized as follows: (1) Exceptional properties of adhesion when applied to a properly prepared surface; (2) dries in one hour to a hard, firm film but retains the elastic properties of rubber: (3) retains the chemically resistant properties of rubber.

●

Small Floodlight

A NEW "Baby" floodlight announced by the General Electric Co., Schenectady, N. Y., has a lens of 6 in. diameter. It can be screwed on a 1½-in. pipe and can be readily adapted for the lighting of signs or other applications where a pipe mounting is used.

The new floodlight supplements a line of small, inexpensive units which includes the "Handy" with an 8-in. lens and the "Senior" with a 10-in. lens. The new "Baby" is designed for use with a 150-watt lamp. The finish and material of reflector, casing and lens are the same as the preceding floodlights of the line.

Prospects of Highway Work in Illinois

FRANK T. SHEETS, chief highway engineer, Illinois State Department of Public Works, recently said:

"Illinois has the most comprehensive and adequate highway system of any like area in the world.

"The State Division of Highways is maintaining a total of 11,398 miles of improved roads, of which 8701 miles are on the state bond issue system and 2697 miles consist of state-aid or principal county trunk highways built under state supervision.

"All state highways have been constructed without one cent of direct taxation, the cost being paid in license fees, gasoline taxes, from federal-aid funds, and proceeds of state bonds, the latter to be paid, principal and interest, from motor license fees.

"Thus far this year the state has completed 398 miles of pavement and has 344 miles under contract or advertised. In addition, bids will be received for 250 miles more paving within the next 45 days. The various counties have built a total of 355 miles of pavement under state jurisdiction and have 355 miles additional under construction.

"The state and counties combined probably will complete over 1300 miles of pavement this year, as well as a large amount of grading and bridge work, and will enter 1933 with a sizable amount of work under contract for next season's construction. Part of this work can be carried on during the winter months, thereby providing employment in that period.

"During the present economic situation, highway construction in this state has furnished employment to thousands who otherwise would be without means of livelihood. In order to provide the utmost in unemployment relief, the state has kept under contract the maximum amount of construction its financial resources would permit.

"If our present highway revenues are not disturbed or diverted to other uses, the remaining mileage on our state bond issue system can either be completed or financed by the end of 1933. However, it still will be necessary to widen many roads already built, to build many railway and highway grade separations and to add other betterments, to improve city streets, and to construct a number of large bridges over the Illinois river. This additional work will require the revenues of about three years to complete.

"It is apparent that some of our gravest highway problems arise in congested centers and on city streets occupied by state routes. To meet this condition the highway department has widened to 40 ft. of traveled way practically all radial roads for a distance of 30 miles from the city of Chicago.

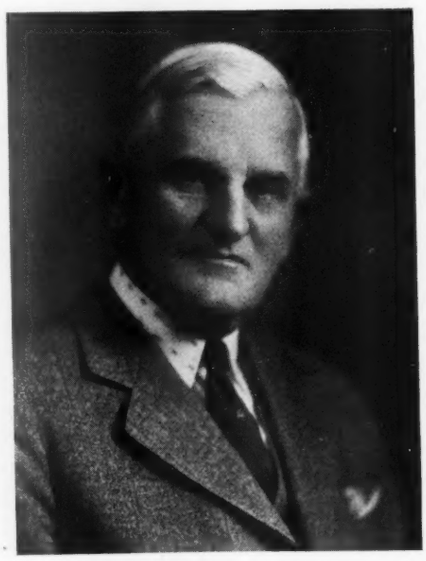
"Proper enabling legislation has only recently made it possible for the department to make over for maintenance, construction and reconstruction all city streets occupied by state routes in all cities of the state, regardless of population. Much will be done during 1932 and 1933 to meet traffic problems in cities and congested centers.

"The last session of the state legislature also created a special commission to make a study of the highway needs of the state and to recommend to the next general assembly a future road program for the state. When the general assembly in 1933 undertakes this problem our 10,000 mile state highway system will be nearing completion and new laws or policies will have to be adopted.

"If the plan then adopted meets equitably and fairly the needs of all classes of people, and if our funds are fairly distributed and their use properly safeguarded, Illinois should, in the next ten years, see an era of highway development which will completely surpass the remarkable achievement of the last ten years."

George Steele Earnshaw

GEORGE S. EARNSHAW, for many years a crushed-stone producer in Illinois and in Georgia, and a brother of Fred O. Earnshaw, president of the Carbon Limestone Co., Youngstown, Ohio, died September 17. In recent years he had been a salesman with the Illinois Powder Co.



George Steele Earnshaw

He was a son of Ono Earnshaw, a quarry owner and operator at Lemont, Ill., on property now owned by the Consumers Co., Chicago. He was born in 1865.

Mr. Earnshaw is survived by a widow, Frances New Earnshaw, and three sons, A. G., F. S. and George M. Earnshaw, who is a member of Rock Products staff.

Over-Doing the Gas Tax

AN EDITORIAL in a recent issue of the *Chicago Daily News* states:

"Prof. F. G. Crawford of the school of political science of Syracuse university, in an article entitled "Our Gasoline Government" in the current issue of *State Government,* points to indications that taxation of gasoline is being overdone. Last year the number of registered motor vehicles in the United States decreased by 731,000. That decrease, says Prof. Crawford, was due in part to heavy taxation imposed on motorists through license fees and taxes on gasoline. The burden of the latter tax has brought about a reaction. In recent months attempts to increase the tax have been defeated in New Jersey, Massachusetts and North Dakota. Each of those states levies a tax of 3c. a gallon, as does Illinois.

"As taxes on gasoline go up, the gasoline bootlegger increases his activities. Illinois has had striking experiences with that form of profitable rascality. The American Petroleum Institute, because of lax enforcement of gasoline tax laws and for other reasons, has organized a tax-evasion committee in every state. In Illinois, as in other states, the authorities have received valuable assistance from that source. Reputable dealers, of course, suffer from the dishonest competition of gasoline bootleggers, as do state treasuries. Some states, like Pennsylvania, have large forces patroling their borders to prevent the smuggling of untaxed gasoline.

"The present tendency of state lawmakers to divert the proceeds of the gasoline tax from road construction to unemployment relief leads Prof. Crawford to say: 'While the state governments are looking for means of providing employment and are viewing the gasoline tax as a means of raising revenue for relieving unemployment, there is a curtailment of highway construction. Highway work uses more labor than any other governmental activity, and by curtailing highway construction the states have actually increased unemployment.'"

To Increase Capacity of Illinois Gravel Pit

FOR several months Guy Webb, farmer near Mahomet, Ill., has been working a gravel bank on his farm. He has recently contracted with W. H. Troike to open a pit there, the *Bloomington Pantagraph* reports, and several thousand dollars worth of equipment has been shipped there and will be installed to produce state inspected, washed sand and gravel. Stripping operations are already under way.

Cement Manufacturer Adds Masonry Cement

THE Trinity Portland Cement Co., Dallas, Tex., announces that it has started to manufacture and market a masonry cement.

This product is manufactured under a process patented by the Silica Products Co. of Kansas City, and is composed of portland cement, finely pulverized limestone rock and "Aquagel." The cement will be sold under the name of "Trinity Mix."—*Dallas* (Tex.) *Craftsman.*

THE INDUSTRY

Incorporations

Hyde Sand and Gravel Co., Enid, Okla. Parry G. Hyde and Harold Taft.

Progressive Cement Block Co., 50 Court St., Brooklyn, N. Y., $10,000. V. J. Ferreri.

Silica Supplies Ltd., Toronto, Can., $250,000. John H. Colville and Walter B. Laidlaw.

Schutte Realty Co., Milwaukee, Wis., $10,000. H. A. Schutte. Stone, building materials, etc.

Ames and Carroll Sand and Gravel Corp., 501 East 161st St., New York City, $10,000. P. Collins.

Dewey Portland Cement Co. of Texas, Dallas, Tex., $2,000. Francis F. Bokern, C. B. Bokern and M. L. Refle.

Talc Mining and Milling Corp., Glendon, N. C. Edw. H. Simpson, Carthage, N. C., and Walter C. Daligny, Troy, N. C.

The Natural Asphalt and Petroleum Co. of Ohio, Columbus, Ohio, 250 shares of no par value. R. L. Brown, 96 Lexington Ave., Columbus; W. H. Jones and Esther M. Coleman.

Forestport Sand and Gravel Corp., Utica, N. Y., $10,000, consisting of 100 shares, par value $100 each. H. E. Griffith, 7 Grant St., Utica, D. Collis Wager and Ernest W. Brackett.

Ancho Gravel Co., Ancho, N. M., 600 shares of no par value. David R. Williams, C. A. Stanfield and W. J. Holleman, all of Tulsa, Okla. C. L. Severy, Ancho, N. M., statutory agent.

Quarries

L. W. Hayes has started work at his quarry in Marysville, Mo.

Mrs. Oscar Anderson has sold her granite quarry in Rocklin, Calif., to Guy F. Atkinson & Co.

Illmo, Mo. Work has been started at a quarry here, stripping has been completed and drilling is in progress.

Tripoli, Ia. A crusher with twice the capacity of the former equipment has been installed at the Alcock quarry here.

Utah-Idaho Sugar Co. has opened a quarry near Lampo where 30 men are quarrying limestone for the sugar plant.

A. J. Colyer has been awarded a contract to furnish stone on road work which he will obtain from a quarry at Somerset, Ky.

Carrollton, Mo. It is reported the state highway department is considering opening a quarry either in Carroll or Livingston county.

Wheeling, W. Va. Ohio county commissioners have opened a sandstone and a limestone quarry recently. The quarries are working two day shifts.

Northwestern Co., Grand Rapids, Mich., has been operating a quarry on Big Summer Island, south of Point Detour. Shipments are being made by boat.

Stone and Co., contractors, are operating a quarry on the Graham farm near Richmond, Mo. Between 17- and 20,000 cu. yd. of rock will be quarried.

Consolidated Rock Products Co. has started operation at its new plant near Azusa, Calif. Construction of this plant was reported in the July 30 issue of ROCK PRODUCTS.

Macon, Mo. Rock quarries will be opened in Randolph, Livingston and Mercer counties during the coming winter. Rock will be placed in stock piles for use in road work in the spring.

Hartshorne Quarry, Hartshorne, Okla., has been opened after having been closed for a long period. R. R. Hennagin is in charge. Material is being furnished the Rock Island railroad for ballast and for road contracts.

Sand and Gravel

Greenville Gravel Co., Urbana, Ohio, suffered a loss by fire at its plant recently.

Commercial Gravel Co., San Francisco, Calif., recently filed an involuntary petition in bankruptcy.

Lutesville Sand and Gravel Co., Colfax, La., has been operating its plant there day and night for some time.

Toledo, Ia. A new gravel pit is being operated in Tama county under the supervision of county engineer, Harry Rager.

Marietta Concrete Co., Marietta, Ohio, has placed its new sand and gravel plant in operation and is operating at capacity.

Paul Morris and Saul Morris, owners of the McKinley Gravel Works, Jamestown, Calif., have bonded and leased it to Bert Gee and Associates.

Tennessee Sand and Gravel Co., Sheffield, Ala., which is operating its dredge near Rhea county, Tenn., reports that due to the low stage of the river its operating expense will be increased.

Friend, Neb. Gravel pits are being opened in Saline county and one is being opened in Seward county. The approval of material from these pits resulted in a low bid for gravel state roads in this vicinity recently.

Cement

Giant Portland Cement Co. resumed operation of its plant at Egypt, Penn., September 15.

Alpha Portland Cement Co. planned to resume operations at its Birmingham, Ala., plant, September 17.

Superior Portland Cement, Inc., has closed its plant at Concrete, Wash., indefinitely. Shipments will be made from stock.

Lone Star Cement Co. of Kansas has resumed operation of its plant at Bonner Springs after a two months' shutdown.

Bessemer Limestone and Cement Co., Bessemer, Penn., has resumed operation of its cement plant, operating at two-thirds of capacity.

Yosemite Portland Cement Co., Merced, Calif., has closed its plant for 60 days to rebuild kilns. Other departments of the plant will continue in operation.

Fenton, Mich. A group of 30 men from here recently called on Governor Brucker asking that contracts for cement for state work be given the Aetna Portland Cement Co.

Olympic Portland Cement Co., Seattle, Wash., was presented its safety trophy by the Portland Cement Association on August 25. Talks by Governor Hartley and general superintendent A. F. Krabbe featured the program.

Lehigh Portland Cement Co. expects to resume operation at its Metaline Falls, Wash., plant early in November. W. G. Perrow, district manager, recently reported a decided improvement in the country trade and said that present indications were that business in the last six months of 1932 would exceed that of the same period of 1931.

Southwestern Portland Cement Co., Osborn, Ohio, dedicated its safety trophy from the Portland Cement Association on September 17. After the dedication a program was held and a number of prizes were given to the winning contestants. The company was host to the Foreman's club of Dayton, Ohio, on the day of its dedication.

Lime

Western Lime and Cement Co., San Francisco, Calif., has filed a petition in voluntary bankruptcy listing liabilities as $22,409 and assets as $19,511.

W. B. Mott, Bells Landing, Penn., is working a vein of limestone on his farm and has installed a crusher and kiln and is producing lime in commercial quantities.

Hamburg, Germany. Sales of lime for fertilizer to farmers have been materially less than last year. There has also been a marked decline in chemical, paper-making and the iron and steel industries. Exports were negligible and producers claim that Germany did not restrict imports of lime to offset restrictions by other countries to which Germany exports.

Silica

J. H. Cowell, owner of silica deposits west of Meade, Kan., has leased additional holdings and production is being increased. The output is being shipped to Kansas City for processing.

Cement Products

E. M. Olson, St. Clair Shores, Mich., has developed an insulated concrete block and an insulated roof tile.

Pressure Pipe Co. of Canada, Ltd., North Vancouver, B. C., has officially opened its new plant for the manufacture of high pressure concrete pipe.

Northwest Concrete Products Association held its midsummer meeting at Pacific Beach, Wash., August 19-20. Sixteen active products plants were represented.

Stone Products, Ltd., will build a plant at Toronto, Ont., Canada. Necessary land has been purchased and a railway siding will be installed. The company will manufacture garden furniture, memorials, trimstone and other concrete products.

Waco, Tex. Interest in concrete drain tile is being developed throughout Texas. A demonstration was held on a farm near here recently where instruction was given in the installation of concrete tile systems of garden irrigation. Seventy-five farmers attended.

Other Rock Products

Lovell, Wyo. All three bentonite plants in the Upton area are being operated at capacity.

Standard Slag Co. officials at Youngstown, Ohio, report its plants are now operating at a small profit.

Commercial Lime Co. has recently opened several of its lime rock plants in the vicinity of Ocala, Fla., after being idle for several months.

Mineral Products Co., with headquarters in Minneapolis, Minn., has shipped its first car of fuller's earth from its plant at Clayton, Ala. Capacity of the plant is 100 tons per day.

Personals

Howard Leh, general manager of the Keystone Portland Cement Co. at Bath, Penn., recently explained the manufacture of cement at a luncheon of the Kiwanis Club in Harrisburg.

Gov. W. T. Gardiner of Maine, chairman of the board of the Pacific Coast Cement Co., Seattle, Wash., recently visited at the company offices while inspecting plants in which he is interested on the Pacific Coast. He also attended the Legion convention at Portland, Ore.

S. L. Avery, president of the United States Gypsum Co., is a member of the organization committee which is engaged in the formation of a new national bank in Chicago to succeed the Central Republic Bank and Trust Co., of which Chas. G. Dawes is chairman of the board.

Obituaries

A. Q. Stremmel, vice-president of the Basalt Rock Co., Napa, Calif., died recently.

James Greig, owner of the stone quarry at Susanville, Calif., which operates under his name, died recently.

J. Frank Zoller, 54, tax attorney for the General Electric Co., died September 3. Mr. Zoller was one of the country's foremost tax experts.

Rupert H. Eastwood, 52, who operated three sand and gravel plants near Grayville, Ill., died September 5 from heart disease.

Chas. Gibeau, 57, Detroit, Mich., manufacturer of concrete blocks until two years ago, died, August 13, at his summer home at Detroit Beach.

Charles H. Sawyer, 84, died August 23 in Toledo, Ohio. Mr. Sawyer was in the stone and building supply business with his father, whom he succeeded in business.

Elliot L. Morris, 34, formerly general superintendent of the American Lime and Stone Co. plant at Bellefonte, Penn., died at his home in Searcy, Ark., September 3, where he has more recently been engaged in quarrying.

Manufacturers

Lincoln Electric Co., Cleveland, Ohio, announces the appointment of G. E. Tenney as sales manager of the Chicago district.

Louis E. Underwood, managing engineer of the stationary motor engineering department of the General Electric Co. at Lynn, Mass., has been appointed manager at the Pittsfield, Mass., works of the company to succeed E. A. Wagner.

Glifford-Wood Co., Hudson, N. Y., announces the promotion of W. H. Warford to the position as manager of its entire western division activity. Mr. Warford replaces W. H. Towne, who will specialize in Gifford-Wood equipment in the ice industry in the future.

W. H. Warford

Keystone Driller Co., Beaver Falls, Penn., announces promotion of H. H. Elmire to field engineer with headquarters at Beaver Falls. James Shearer has been appointed to succeed Mr. Elmire at Arlington, N. J.

Worthington Pump and Machinery Corp., Harrison, N. J., announces that arrangements have been completed for the joint use of manufacturing, engineering, sales and service facilities of the meter division of the Worthington Pump and Machinery Corp. and those of the Gamon Meter Co. George H. Gleeson will be in charge of the meter sales activities of both companies.

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making those much needed replacements of worn parts of your equipment by buying

REPAIR PARTS

Prices of most repair parts are now lower than they have been for years. Equipment placed in first class condition now will be ready to operate at full capacity when consumers begin to buy your products.

Low costs will be necessary to make resumption profitable—low costs depend largely upon efficient equipment in best possible working order.

And ***remember,*** when you buy repair parts, that the manufacturer of the machine for which they are intended has gained experience with many similar machines in other plants—that he is constantly making improvements in those parts based on this experience —that his shop is equipped with tools specifically for the manufacture of such parts—and that many of the parts are patented.

So that it would pay to buy from the machine manufacturer, who is interested in supplying parts that will assist in obtaining the highest efficiency from the machine itself.

F. L. SMIDTH & CO.

Engineers

225 Broadway **New York, N. Y.**

Designers and Equippers of Cement Making Factories

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• Preformed and Internally lubricated MACWHYTE Wire Rope is recommended as the latest development in the art of making quality wire rope. Users are profiting because of the longer life resulting from these outstanding improvements.

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Use MONARCH WHYTE STRAND for Extra Strength

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